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The N. E. L. A. Convention in Chicago While the attendance at the Chicago convention of the National Electric Light Association was not so large as that at the New York convention in 1911, yet it was probably greater than at any other convention in the history of the organization. With few exceptions the discussions on the papers and reports were neither especially vigorous nor extensive, but there were several noteworthy events, the most important of which was, perhaps, the presentation of the well-considered report on public policy which committed the society unreservedly to the principle of regulated monopoly in public-utility operation, as noted elsewhere. The entertainment features were carefully planned and well carried out, the opening reception being a brilliant affair, as was also the Blackstone Hotel concert for the ladies. The arrangements for the formal sessions were ample and convenient, and much success attended the experiment of holding some of the sessions in a large tent on a lawn adjacent to the Medinah Temple. Considered as a whole, the 1913 convention will occupy a worthy place in the history of the activities of the National Electric Light Association.

Central-Station Public Policy The high plane upon which the larger affairs of the National Electric Light Association are directed is evidenced by the report of its public policy committee. As in other years, this influential committee expressed the spirit of the leaders of the industry in meeting their responsibilities toward their employees and the public—a spirit which ought to stimulate the former to greater loyalty and a larger confidence in the value of their daily tasks, and which should help to clear away any misunderstanding of the association's aims on the part of the latter. One cannot read the report without feeling that the affairs of the industry are in wise hands or without a glow of optimism for the future. The range of subjects covered by the committee may be grouped under welfare work and public relations, and in all the consequent subdivisions the report expresses the best thought of our day and is a genuine contribution toward social and economic betterment. This outward work of the committee for the broadest welfare of the industry as a whole by no means represents the total usefulness of its distinguished captains to the organization, for each year many opportunities to serve are embraced in a quiet but effective way for the greatest good of all, with no calling from the housetops and at much personal inconvenience and sacrifice. Steered along such a course and by such a chart, the association may face the days to come with sustained confidence and the promise of giving still larger service to the civilization in which it is so powerful a factor.

Veto of New York Hydroelectric Bill In vetoing the Murtaugh hydroelectric bill Governor Sulzer displayed commendable courage and foresight, particularly in view of the opportunity of giving his approval to a measure which, although seriously defective, aimed to carry out the policy of conservation incorporated in the platform of the political party which elected him to office. Looking toward the future and bearing in mind the Governor's announced intention of appointing a commission to report on the whole scheme, we would urge most earnestly that the personnel of such a commission be made up of engineers and economists of recognized standing and authority who will consider the whole matter from a scientific and economic rather than political point of view. As we have had occasion to point out before, the inherent weakness in municipal or state ownership lies in the great difficulty, if not impossibility, of securing management which in all respects measures up to the ability displayed in managing public utilities under private ownership. This question is undoubtedly one of the most serious of the problems which will arise, especially in view of the magnitude of the proposed undertaking. The commission should obviously be so constituted as to enable it to consider this phase of the matter authoritatively and recommend a plan of administration which will carry the whole scheme as far as possible from the realm of political influence and the clutches of hungry office seekers.

Underground Construction The very practical report of the N. E. L. A. committee on underground construction deals with a variety of topics of widespread interest. The subject of carrying capacity of cables is considered at some length, especially from the point of view of the maximum temperature reached in the insulator. It fortunately happens in all parts of the world except the tropics that the peak load is greatest in midwinter and least in midsummer—because the lighting element enters into it so largely. In midwinter the temperature of the ground and cable sheathings is frequently some 20 deg. C. lower than in midsummer, which means that the temperature elevation can be carried 20 deg. C. higher, with a corresponding increase in current carried. It seems that this available margin of winter carrying capacity may be utilized much further than heretofore. The relative advantages of the triple-sector or clover-leaf conductor cable over the triple round-conductor cable are fully brought out. It is worthy of note here that the clover-leaf cable has been popular in Europe for some time. Standard forms of specifications offered for the purchase and selection of high-tension cable should be very serviceable to the smaller companies, of limited experience in this direction.

Survey of Protection Conditions

In an interesting paper presented by Prof. E. E. F. Creighton at the N. E. L. A. convention, it was pointed out that in spite of the advantages of the aluminum lightning arrester the multi-gap arrester holds its own in distributing systems operating at about 2300 volts, partly owing to its lower cost and partly because transformers working at this pressure have a factor of safety of five, in regard to voltage, while in high-potential transformers the factor of safety usually falls below three. A noteworthy change has been made in aluminum lightning arresters within the last year or so, the organic electrolyte having been superseded by an inorganic solution. In the electrolyte previously used a vegetable growth occurred which transformed the electrolyte to vinegar, with a detrimental action on the films of the plates. It is curious that a vegetable should be able to undermine the protective powers of the aluminum arrester.

A good practical suggestion for driving an iron earth pipe 8 ft. deep, as given by Prof. Creighton, is well worth remembering. A 4-ft. drive is first made with a pipe somewhat larger than is needed. This first section is then withdrawn and the final smaller pipe put in its place. This brings the final pipe to a depth of 4 ft.—where the top can easily be reached with a sledge hammer without high staging, as only 4 ft. more have to be driven.

Electricity on the Farm

Two important reports at the N. E. L. A. convention dealt with the rural uses of electricity. It is an unfortunate fact that little progress in the direction of utilizing electrical energy on the farm has been made in the East. In the first place, this section is not a farming country in the sense in which that phrase applies either to the rich plains of the Middle West or to the wonderful country still nearer the Pacific, in which irrigation changes the land from a desert to a garden. In such territory on the Coast the peak load for the year has actually been shifted from winter to summer through the effect of rural distribution, quite largely for irrigation purposes. The consensus of opinion the country over seems to be that great extensions of lines simply for the purpose of serving a rural territory are seldom justified, but where large transmission systems are in operation admirable work can be done in adding up rural load for irrigation, lighting and small motor service. In the aggregate a considerable amount of business has been secured even aside from those territories in the further West where irrigation is greatly in demand.

The field is worth cultivating, but the work must be done cautiously, steadily and with a keen eye for future extensions. One farm is not likely to require any great amount of power, a few kilowatts at the outside, aside from regions where irrigation is important. Yet in a good farming territory the aggregate load which may be connected is considerable, and it is important not only from the standpoint of revenue gain but from that of such service to the community as must inevitably help the cause of general energy transmission. Personal gain from transmission service is highly effective in building up popularity and in smoothing the way toward the constitution of those great electrical networks which will mean so much for the future. There are scores of purposes to which electricity may be applied in farm service. Most of them are applications for small motors, with lighting and heating as subsidiary uses, and in addition there are the various chances for using electricity in the farmhouse in the line of ordinary domestic service. With proper arrangement of the apparatus it is possible to employ a single motor for a wide variety of uses which will greatly cut down the fixed charges on the equipment. These are liable to be high owing to the intermittent conditions of use. To acquire a rural load of any magnitude is not an easy task in most parts of the country, but it is well worth trying to introduce a motor here and a motor there for the purpose to which it can be economically applied and to follow up steadily the development of the work.

Prime Movers

The report of the N. E. L. A. committee on prime movers is this year, as always, one of the most interesting and valuable presented. It takes up in succession the improvements made in water-power, in steam-power and in gas-power, all tending to simplification of the plant and lower operating expense. Even in water-power, which has sometimes been supposed to be a fair subject for standardization, there have been some notable minor improvements, particularly in the development of thrust bearings suitable for use with vertical-shaft turbines where these are desirable. Incidentally it is worth mentioning that some extremely high efficiencies have been obtained during the past year in large turbine units, thus showing plainly that the last word has not been said on waterwheel design. Steam turbines, too, have been the subject of material improvements. The drift of design has been in the direction of horizontal machines worked in many stages and at specially high superheat. One of the very interesting developments is the ingenious turbine of Dr. Farranti, the principle of which is continuing the superheating so as to keep the steam in a perfectly gaseous state in its travel through the turbine, re-superheating taking place between the stages. A consumption of steam as low as 6 lb. per hp-hr. is mentioned as within reach of turbines of this construction, the thermo-dynamic efficiency being as high as 24 per cent.

Concerning oil engines the report gives some extremely interesting details. There are now some 75,000 hp in engines of the general Diesel type in sizes up to 1000 hp. One report from an electric-light company using engines of this type gives the consumption of oil per net kw-hr. as 0.13 gal., which, with oil at 3.5 cents per gallon, brings the fuel cost down to the excellent figure of 0.455 cent per kw-hr. As compared with the results obtainable with five-dollar coal, this result means a considerable saving. The maintenance estimated is at least 50 per cent higher than that of a steam plant of the same output rating. Conditions indicate that a larger reserve plant must be carried with oil engines than under ordinary circumstances. The gas turbine is reported as not yet having reached a commercial stage, although some promising experiments have been

tried and are under way. Nothing, however, is as yet past the experimental stage so that this prime mover cannot now be considered seriously. The report is exceedingly well worth study as a résumé of the present status of prime movers.

Unified Control of Electrical Systems

In our issue dated May 31 appeared articles relating to the systems supplying energy in Chicago and throughout Central Illinois territory. The present issue contains articles dealing with the generating, transmitting and distributing systems of the Public Service Company of Northern Illinois and the Illinois Northern Utilities Company. The history of the development of these companies covers many interesting facts. The North Shore Electric Company, which was organized a number of years ago for unifying the electric service in the suburban districts of Chicago, was merged comparatively recently into the Public Service Company of Northern Illinois, which took in also the Economy Light & Power Company of Joliet, the Illinois Valley Electric Company and other companies in Kankakee and elsewhere. This company now serves a large area in northeastern Illinois, consisting of the suburban districts roundabout Chicago, a number of smaller cities and towns such as Evanston, Joliet and Kankakee, and a wide extent of rural territory. It has a considerable number of farmers among its customers.

The Middle West Utilities Company was organized in May, 1912, to acquire public-utility properties, particularly in the smaller cities and towns, and to organize and own subsidiary state companies to take over and operate the properties acquired in different states. This plan of operation has been developed by the Middle West Company, to a greater or less extent, in the States of Illinois, Indiana, Kentucky, Michigan, Oklahoma, Missouri and some of the New England States. The total number of communities served by this young giant of an organization, which has been in existence only a year, is about 280. Prominent among its state subsidiary organizations is the Central Illinois Public Service Company, with operating office in Mattoon, which serves about 125 communities. In the northwestern part of the State the Illinois Northern Utilities Company has been, or is about to be, affiliated with the Middle West Utilities Company. This company serves about fifty communities. The Public Service Company of Northern Illinois and the Illinois Northern Utilities Company are operated in close harmony, and the system of the former is also physically connected with that of the Commonwealth Edison Company of Chicago. The system of the Central Illinois Public Service Company is operated more independently in a physical sense, but all the companies named are directed from common Chicago headquarters.

The idea of syndicate operation of public utilities is far from new, but the plan of neighborhood grouping has been carried out more extensively in Illinois perhaps than anywhere else, unless exception be made in favor of the extensive systems of the Pacific Gas & Electric Company, operated from San Francisco. Many well-informed men declare that monopoly is an economic necessity in the electric-service industry. Competition does not make for cheap energy; it has been replaced by state or municipal regulation to a very great extent. It seems fair to assume that the regulation of monopolies by the community is more in accord with scientific methods than regulation by unrestrained competition. Unified operation renders practicable the massing of production and the utilization of the diversity-factor, making it possible to sell electrical energy more cheaply to all classes of consumers. In general, it is contended that the syndicate system of supply is economical and the small-individual-community method wasteful. Cheap energy means better factory conditions to some extent; it should mean some betterment of conditions of life and labor, and it should reduce the cost of transporting passengers and merchandise. Indeed, the possibilities of cheap energy are of great sociological significance. It is predicted that the time will come when there will be a network of transmission and distribution lines between the Mississippi River and the Atlantic Ocean with large generating stations at points where it is found most economical to produce electrical energy. In this way will the energy be distributed at the minimum of cost to the maximum number of users.

Developments in Protective Apparatus

The thorny path of high-tension transmission climbs yearly into higher currents as well as voltages and calls for more powerful automatic apparatus capable of protecting the generating plant. Circuit-breakers are called upon to rupture in air currents as great as 24 kiloamp at 1500 volts in railway service and to rupture in oil 600 amp at 120 kv or more. Lightning arresters are called upon to provide safe spillways for voltages in excess, say, of 200 kv. In his N. E. L. A. paper on recent developments in protective apparatus, Mr. J. N. Mahoney describes some of the improvements lately made in this important class of devices. It is pointed out that alternating-current generators when suddenly and violently short-circuited may develop from five to fifty times the rated-load current for the first second or two, after which time the current falls to the "sustained short-circuit current," that may be only two or three times the rated-load current. Consequently, in order to protect such generators from the very large mechanical stresses exerted in the first moments of a near-by short-circuit, either permanent reactors may be inserted in the circuit near the generator or use may be made of automatic circuit-breakers of the quick-action type. Some of the latter can rupture the current in one-tenth of a second after the short-circuit has been established.

For very high currents and voltages breakers are now provided with self-contained reactors which are cut into circuit when the breakers operate. It is also becoming frequent to install high-tension oil breakers and switches out of doors, with suitable weather protection, owing to the large volume of space they occupy and the convenience of such construction. For severe service the aluminum lightning arrester seems to have displaced all others, especially for high voltages. It is now recognized as best to recharge such aluminum arresters daily, as a precaution against the dissolving away of the protective films.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

New York State Hydroelectric Bill Vetoed

Governor Sulzer of New York on May 27 vetoed the Murtaugh-Patrie bill favored by the New York Conservation Commission and having for its object the development and distribution of electrical energy under state ownership and management, somewhat after the scheme which now obtains in the Province of Ontario in Canada. A detailed account of the proposed legislation was published in these pages on Jan. 4. In his memorandum the Governor stated that for the general welfare he intends to appoint a commission of experts and disinterested citizens, more or less familiar with the whole subject matter, to investigate not only the project vetoed but the Long Sault water-powers, the Niagara water-powers, the Genesee water-powers and others, with a view to determining what is the best thing to do ultimately for all concerned. The commission is to report its conclusions with appropriate bills for the consideration of the next Legislature.

A résumé of the proposals of the New York Conservation Commission in this connection was published on page 33 of our issue dated Jan. 4, 1913. Much public interest was aroused by the proposals, which were frequently discussed in the daily papers. News items and comments on the situation appeared in our columns as follows: Jan. 11, page 81; Jan. 25, page 176; Feb. 1, page 235; Feb. 8, pages 277 and 280; Feb. 15, page 336; March 15, page 555; March 22, page 601; March 29, page 659; April 5, page 711; April 12, page 760, and May 10, page 968.

Pennsylvania Department of Labor and Industry

On June 2 Governor Tener of Pennsylvania approved a bill creating a department of labor and industry and appointed Prof. John Price Jackson, dean of the School of Engineering of the Pennsylvania State College, as the commissioner. In accordance with this bill there will be created three bureaus, known as those of inspection, statistics and arbitration. The bureau of inspection will take over the duties and powers of the former department of factory inspection. The bureau of statistics will handle industrial matters and will collect statistics relating thereto. One of the duties of the bureau of arbitration will be to mediate in cases of strike.

Dinner to President-elect Mailloux

Past-president Gano Dunn of the American Institute of Electrical Engineers was the host and toastmaster at a dinner given to President-elect C. O. Mailloux at the University Club, New York, on May 28. The personal and professional qualifications of Mr. Mailloux, which for years have caused him to be looked upon as a future president of the A. I. E. E., and the conditions with reference to the preparations for the forthcoming International Electrical Congress which make this the logical time for him to become president, were set forth in brief addresses by Past-presidents Bion J. Arnold, Dugald C. Jackson, John W. Lieb, Jr., and Henry G. Stott. Among those who were called upon for remarks on the past, present and future affairs of the Institute were Messrs. A. Aaron, H. H. Barnes, Jr., J. J. Carty, Bancroft Gherardi, A. S. McAllister, W. S. Murray, Farley Osgood, M. I. Pupin, D. B. Rushmore and C. W. Stone. The dinner was characterized not only by elegance in arrangements but also by a striking display of harmony in spirit and unity in purpose of the various well-wishers of the Institute.

Convention of the National Electrical Contractors

Although most of the sessions to be held in connection with the annual convention of the National Electrical Contractors' Association at Chattanooga, Tenn., will be solely for members, yet there will be several open sessions to which visitors will be admitted. On the morning of July 16 there will be an open session at the Hotel Patten, at which several subjects of general interest to the trade will be discussed. In the evening of this day, beginning at 7 o'clock, there will be a lecture on illumination. Following this lecture, beginning at 8 o'clock, there will be a reception and dance for members and guests. On the afternoon of July 16, on the morning of July 17 and during the morning and afternoon of July 18 business sessions will be held for members only.

Pennsylvania Utilities Bill

The public utilities bill which was passed by the Pennsylvania Senate has been recommitted to the corporations committee. It is expected that several amendments will be made but that none will tend to weaken the legislation.

Electrical Supply Jobbers' Meeting

Economical methods of conducting an electrical jobbing business, made imperative by the present legislation regulating business enterprises, were discussed in executive sessions at the spring meeting of the National Electrical Supply Jobbers' Association, held in Chicago on May 26, 27 and 28. Mr. Frank Overbagh, of Chicago, secretary of the association, presided. Mr. Norman Webster, representing Niles & Niles, accountants in New York City, spoke on the "Proper Methods of Classifying Accounts."

During the open meetings, which were held on Tuesday afternoon and Wednesday, short talks were given by Mr. W. E. Robertson, of Buffalo, vice-president, and Mr. J. M. Wakeman, of New York, general manager of the Society for Electrical Development, Inc. Mr. Wakeman confined his remarks to the organization and aims of the society which he represents. Traveling electrical demonstration shows and moving-picture films were mentioned as means which would be used by the society in educating the public to the necessity of electricity. A chart was shown by Mr. Wakeman which classified members of the society according to their annual estimated business income. Following the talk of the society's general manager, application blanks for membership in the Society for Electrical Development were distributed. Before the meeting was over twenty-two of the applications were signed and handed in, making a total of about thirty-five applications which have been made by electrical jobbers so far. The meeting closed with an executive session. About 150 attended the convention.

Convention of Electrical Development Society

Among the various electrical societies and associations which held their meetings in Chicago during the convention of the National Electrical Light Association was the Society for Electrical Development. What was marked as the first annual meeting of the society was held at the Hotel Sherman, in Chicago, on June 2. In the absence of President Henry L. Doherty, Mr. Ernest Freeman, the first vice-president, occupied the chair.

The main topic brought before the meeting was the adoption of two amendments to the by-laws. Before any action was taken on them, Mr. J. M. Wakeman, general manager of the society, explained the need of the amendments. He said that heretofore many electrical manufacturing companies were not willing to join the society for the reason that the old classification of members divulged their annual business. To eliminate this objection a chart was drafted, classifying the members by letter but still allowing a certain leeway which would not divulge variations in business from year to year or give too close a line on the annual revenue.

The amendments to the by-laws which were adopted at this meeting of the society provided for the presence of at least seven members of the board of directors to constitute a quorum, and for an alternate plan of classifications of members, which was compiled by a sub-committee of the executive committee.

Following the adoption of the amendments, Secretary Philip S. Dodd said that 181 members were registered in the society up to the opening of the meeting. Of the $20,476 which was advanced by the twenty members of the board of directors to be used in organizing the society, $8,655.49 has been spent. The membership applications up to date have been accompanied by checks amounting to $999.85, which amount, however, cannot be spent on organization. Mr. Wakeman said that so far about $110,000 has been pledged. The thought was expressed by several that if each member would explain the advantages of the Society for Electrical Development to non-members, the remaining $90,000 necessary before active work can be commenced would be forthcoming within a short period of time.

Mr. C. A. McDougall, assistant to the president of the Toronto Electric Light Company, Ltd., of Toronto, Canada, spoke of the assistance which that company had received already from the society in building up its sales force. On the recommendation of the nominating committee a board of directors was elected as follows: Jobbers, Messrs. W. E. Robertson, Gerard Swope, F. S. Price and W. W. Low; manufacturers, Messrs. A. W. Burchard, L. A. Osborne, W. A. Layman and B. M. Downs; contractors, Messrs. E. Freeman, E. McCleary, J. R. Strong and G. M. Sanborn; central station, Messrs. H. L. Doherty, W. H. Johnson, J. F. Gilchrist and J. E. Montague; directors at large, Messrs J. R. Crouse, H. M. Wilson, C. W. Price and F. E. Watts. The composition of the board is interesting because of the plan of interlocking the interests of the Jovian Order with the society's development One of the members of the board of directors at large is to be the reigning Jupiter, who will hold office one year.

At the board of directors' meeting, which closed the first annual convention of the Society for Electrical Development, the executive officers were re-elected, with the exception that the vice-presidents were placed in a different order. The officers for the ensuing year are as follows: Mr. H. L. Doherty, of New York, president; Mr. W. H. Johnson, of Philadelphia, first vice-president; Mr. W. E. Robertson, of Buffalo, second vice-president; Mr. A. W. Burchard, of New York, third vice-president; Mr. Ernest Freeman, of Chicago, fourth vice-president; Mr. J. Robert Crouse, of Cleveland, fifth vice-president; Mr. J. M. Wakeman, of New York, general manager; Mr. Philip S. Dodd, of New York, secretary-treasurer.

A. I. E. E. Convention Arrangements

An item relating to the convention of the American Institute of Electrical Engineers, to be held on June 23 to 27 at Cooperstown, N. Y., together with an outline of the preliminary program, was given on page 969 of our issue dated May 10. The final program contains several papers not mentioned in our earlier item, as follows:

"A Suggestion for the Engineering Profession," by Dr. William McClellan; "The Adaptation of Automatic Methods to Long-Distance Telephone Toll Switching," by Messrs. H. M. Friendly and A. E. Burns; "Electrolytic Corrosion of Iron in Soils," by Messrs. Burton McCollum and K. H. Logan; "Suggested Specifications for Testing High-Tension Insulators," by Messrs. J. A. Sandford, Jr., and F. W. Peek, Jr.; "Constant Voltage Transmission," by Mr. H. B. Dwight; "Theory of the Non-Elastic and Elastic Catenary as Applied to Transmission Lines," by Messrs. C. A. Pierce, F. J. Adams and G. I. Gilchrist; "Commutating-Pole Saturation in Direct-Current Machines," by Mr. H. E. Stokes; "Electrical Requirements of Certain Machines in the Rubber Industry," by Mr. C. A. Kelsey; "Converting Substations for Basements and Sub-basements," by Mr. B. G. Jamieson; "Operation of Frequency Changers," by Mr. N. E. Funk.

On the evening of Monday, June 23, a reception and dance will be held at the Hotel Otesaga, the official headquarters of the Institute. Following the address of President Ralph D. Mershon on Tuesday morning will be the introduction of President-elect C. O. Mailloux. The various technical sessions of the convention will be conducted under the auspices of the Institute committees, as follows: Tuesday morning, telegraphy and telephony committee and electrochemical committee; Tuesday evening, educational committee; Wednesday morning, high-tension transmission committee; Wednesday afternoon, industrial-power committee; Thursday morning, power-station committee and electric lighting committee; Friday morning, electrophysics committee.

On Thursday afternoon there will be a meeting of the executive committee of the committee on organization of the International Electrical Congress to be held in San Francisco in 1915, while the evening of Friday will be given over to the presentation of the Edison Medal and a conference of officers and section delegates.

A. I. E. E. Pacific Coast Convention

Announcement has been made of some details of the plans for the Pacific Coast convention of the A. I. E. E. to be held in Vancouver, B. C., Sept. 9-11, 1913. A convention committee representing the Pacific Coast sections has been appointed by President Mershon, the chairman being Mr. R. F. Hayward and the secretary Mr. E. M. Breed, Vancouver, B. C. Sub-committees to take charge of the local work of preparing for the convention have been appointed by Chairman Nims of the Vancouver Section, as follows: General committee, Mr. R. F. Hayward chairman; papers committee, Mr. F. D. Nims chairman; transportation committee, Mr. E. M. Breed chairman; entertainment and reception committee, Mr. L. G. Robinson chairman; finance committee, Mr. William McNeil chairman.

The papers committee has tentatively arranged a program of seven papers, including one paper to be presented in the evening as an illustrated lecture, with the ladies invited to attend. It is proposed to present only one paper at each session, giving opportunity for more comprehensive discussion on each paper. The regular business of the convention will end on Thursday, Sept. 11. For the following two days two interesting trips are being arranged to the plants of the Western Canada Power Company at Stave Falls and the Vancouver Power Company at Lake Buntzen.

Convention of the National Electric Light Association

The thirty-sixth convention of the National Electric Light Association was held at El Medinah Temple, Chicago, June 2 to 6 inclusive. The exercises of the convention began on Monday night with a reception to President and Mrs. Frank M. Tait and the opening of the exhibition made by Class D members, following which there was dancing and light refreshments were served. A brief description of the exhibition hall in the basement of the temple, together with a list of the exhibitors, is given elsewhere in this issue. The real work of the convention began with the first general session on Tuesday morning and did not end until sundown on Friday afternoon. In all, eighteen sessions were provided, the general and public policy meetings being held in the main auditorium, the technical, commercial and transmission sessions either in the auditorium or in a large tent on the lawn west of the temple, and the accounting sessions in the reception room on the south side of the main floor. For convenience the papers presented at the various sessions, together with the discussions on them, are grouped under distinguishing heads and published in another section of this issue.

The total registration at the close of the convention on Friday, exclusive of Class B members of Illinois, was 1895. The Class B membership of Illinois numbered 2182, making a total registration of 4077.

Welcoming Address

Mayor Carter Harrison of Chicago being unable to be present, the association was greeted by the Controller of Public Works, Mr. Lawrence E. McGann, who expressed the hope that the convention would result in great good not only to the fraternity but to all the people. The desire for the utmost economy in lighting, he said, is particularly great on the part of the officials having responsibilities in great municipalities, because to the extent that lighting service is cheapened so will residence in great municipalities be more desirable, more pleasant and more safe. In his judgment a private business policy can be better promoted by a reasonable consideration of public service and relations with the public than by a narrow, obstructive service. To this end he suggested that a voice be given to public representatives in the question of rates, as is now done in Chicago, because such a policy will go a great way toward encouraging the extension of lighting systems.

Address of President Tait

In his presidential address Mr. Frank M. Tait, Dayton, Ohio, stated that during the past five years the membership in the association has increased from 1327 to 12,442. He concurred with Past-president Freeman in the belief that the membership in time will reach 25,000 and expressed the opinion that the conventions of the association with the increased attendance are likely to prove unwieldy and hard to handle in their present form.

In order that the association's affairs may be conducted properly and the responsibilities more widely distributed, President Tait suggested that the number of vice-presidents be increased from two to four. He suggested also that plans be laid for greatly increasing the association's yearly income.

In commenting upon the aid which the association offered spontaneously to member companies in distress by reason of the recent tornadoes and floods, Mr. Tait remarked that it is a great tribute to the individual resources of the various companies affected that not one of them called for help. He expressed the hope that the companies will be permitted by the public service commissions to fund the expense for repairs from capital account rather than be compelled to pay the cost out of surplus or earnings account.

Of the numerous activities of the association none has attracted more widespread and favorable attention than that in connection with the publication of the resuscitation rules. Over 100,000 copies of the chart and booklet have been issued to date, and several governments have adopted the recommendations as their official guide.

On motion of Mr. Arthur Williams, of New York, the address was referred to a committee consisting of Messrs. J. F. Gilchrist, of Chicago; W. W. Freeman, of Birmingham, and W. C. L. Eglin, of Philadelphia.

Present Membership

The committee on the organization of the industry, of which Mr. H. H. Scott, of the Doherty Operating Company, New York, was chairman, gave statistics on the present membership of the association. The present membership of 12,442 is apportioned as follows: Class A (operating companies), 1093; Class B (employees of operating companies), 10,256; Class C (individuals), 53; Class D (manufacturing companies), 242, and Class E (associate members), 798. Up to the time of the convention there were forty-two company sections with an approximate membership of 8400, as compared with thirty-seven company sections last year with a membership of 7700. During the year new sections were formed in San Francisco, Cal.; Dixon, Ill.; South Bend, Ind.; Roanoke, Va., and Ottawa, Ont. Nevertheless, out of 105 cities in the United States with a population of 50,000 and more there are only thirty-two company sections, and there are only four company sections in cities with a population ranging from 25,000 to 50,000, out of ninety-seven cities falling in that class. The Class A membership shows a falling off of forty-three from last year, not enough new members having been obtained to offset 118 resignations received during the year because of consolidations of properties.

Report of Secretary

The enormous amount of detail work handled by the association was outlined in the report of Secretary T. C. Martin, and some idea of the work of the association may be had from the fact that out of an income of $100,000 more than 50 per cent was spent in publications. There were printed 18,650 volumes of the *Proceedings* and 156,000 copies of the *Bulletin*, and 30,000 copies of miscellaneous publications were sold or distributed, exclusive of 4000 copies of the "Electrical Solicitor's Handbook," 1100 copies of the overhead-line construction committee's report and a large number of copies of the classification of accounts and the Question Box revision. Almost 3000 copies of the "Meterman's Handbook" have been sold, and since the publication work of the Commercial Section was taken over the office of the secretary has handled the sale of over 200,000 copies of publications for the section. The chart and booklet on resuscitation from shock has brought renown to the organization, and it is difficult to estimate the extent of publication which these invaluable documents have received. The rules have been translated into several languages, notably Japanese and Spanish. Other activities of the home office of the association, such as the lecture bureau, the compilation and distribution of statistics relating to certain branches of work in the industry, etc., were also mentioned. A new edition of 1000 copies of the meter code and a limited edition of the proposed revision of the classification of accounts were prepared for the convention in addition to the fifty reports and papers.

Chairman Ryerson's Address Before Hydroelectric Section

Mr. W. N. Ryerson, of Duluth, Minn., in his address as chairman of the Hydroelectric and Transmission Section called attention to the fact that during the past year there was a departure from the "do-nothing" policy of the national government, when Secretary Fisher issued permits for the use of government lands by power companies and promulgated rules defining to some extent the general policy of the Department of the Interior toward hydroelectric

and transmission enterprises. Unfortunately, however, the change in government makes it impossible to predict what may happen in the future, and lack of harmony between the advocates of centralized government control and states' rights does not improve the outlook. Nevertheless, the educational work carried on by public-service corporations and right-thinking citizens is doing much to mold public opinion in the right direction. Public service commissions have also helped to rend the veil of secrecy which shrouded the workings of hydroelectric companies and have thus brought true facts to light. The speaker announced with much pleasure that the Governor of New York had vetoed the scheme of a state-wide electrical development under governmental auspices, so that the Empire State will not emulate the Province of Ontario for the present at least. In connection with public sentiment and the vital relation it bears to the industry, Mr. Ryerson sounded a note of warning against over-capitalization, claiming that it is not an evil of the past, but is unfortunately seen at present in the consolidations of separate properties under holding companies. There is danger, he said, in any attempt to ignore or to minimize the effects of over-capitalization on account of the ultimate certainty of commission control in all states and the lack of uniformity as to the "fair rate of return" which the various controlling bodies will allow. The speaker concluded with a strong appeal for more earnest and active interest and support from the Class B and Class E membership of the parent body. He recommended that some change be made that will necessitate the payment of section dues to obtain either admission to the meetings of the section or the distribution of the various papers and reports printed.

PRESIDENT-ELECT J. B. M'CALL

MEMBERSHIP OF HYDROELECTRIC SECTION

Chairman R. J. McClelland, New York City, stated that the country has been divided into sections headed by a vice-chairman, including the Pacific Coast, the Northwest, Central West and East. Mr. E. M. Gilbert, of the Central Colorado Power Company, Denver, Col.; Mr. G. H. Bragg, of the Pacific Gas & Electric Company, San Francisco, Cal., and Mr. D. F. McGee, of the Pacific Power & Light Company, Portland, Ore., have consented to act as vice-chairmen in their respective districts. At the beginning of the membership campaign late in 1912 it was found that of 450 hydroelectric power companies of 1000 hp or greater output less than 200 were members of the association and less than fifty were represented in the hydroelectric and power transmission section. An active campaign of membership solicitation is now in progress.

REPORT OF TREASURER

According to the abstract of the report presented by Mr. W. W. Freeman, of Birmingham, Ala., the revenue of the association for the fiscal year of 1912 was $132,255, of which $83,443 was received as dues, $26,412 for publications and $22,399 for convention expenses. The general expenses exclusive of the cost of the convention were $81,220, and the convention expense was $31,913, making the total $113,133 and leaving a surplus of $19,121. At the end of the year the gross assets of the association were $50,331 and its liabilities $28,430, leaving a balance of $21,900, of which $15,063 is invested in bonds and the remainder is in cash.

PUBLIC POLICY REPORT

As was to be expected, the meeting on Wednesday evening was the gala event of the week. Prior to the beginning of the exercises the large orchestra of the Commonwealth Edison Company played numerous selections, and during the rest of the evening music was interspersed between the numbers on the program. The public policy committee's report was read by Mr. Samuel Insull, of the Commonwealth Edison Company, in the absence of the chairman of the committee, Mr. Arthur Williams, of New York, who is now on his way to Europe. The report itself is given in abstract elsewhere in this issue. In commenting on the work of the committee and also on the general trend of the industry, Mr. Insull reiterated much of what he had already said in commenting on the report of the same committee at Seattle on the personnel of the committee and the capital it represents. He also enlarged upon the theme of concentrated generation of electricity and its distribution in all directions, especially with regard to the economics of the question. In Mr. Insull's estimation not less than $2,000,000 is spent yearly by the electric-lighting industry in welfare work, the only return from which is the physical, mental and moral betterment of the employees of the industry—a very valuable asset in any community. Regarding regulation, Mr. Insull saw much that is good as tending to insure the stability of public utility securities, lower the cost of securing money for developments and provide for a fair return upon the investment. Much is wasted in municipal operation of public utilities, and as heavy taxpayers, much more than from selfish motives, the central stations should have a lively interest in discouraging further developments in that field. He accentuated the fact that the lighting business should be monopolistic and that as such it should be subject to a reasonable amount of regulation by properly constituted commissions.

RESUSCITATION FROM SHOCK

Following the presentation of the report of the public policy committee at Wednesday night's session, Mr. W. C. L. Eglin, of the Philadelphia Electric Company, presented the report of the commission on resuscitation from electrical shock, stating that it represented almost wholly the work of the American Medical Association. The report itself is abstracted elsewhere in this issue and is devoted largely to the work of the commission during the year in investigating mechanical devices for producing artificial respiration. Mr. Eglin demonstrated by means of a model the action of the lungs when subjected to the prone pressure method of resuscitation. He showed the proper method of using the prone pressure method on a person shocked. A sample of the apparatus devised by Dr. Meltzer, of the commission, which has the approval of the entire commission as preferable to any of the other devices on the market, was exhibited.

ACCIDENT PREVENTION

Mr. J. B. Douglass, of the United Gas Improvement Company of Philadelphia, closed the evening's program

with an illustrated lecture on accident prevention. Common hazards about utility and other plants were depicted on the screen and the simple means required to eliminate sources of accident were described or illustrated. The various safety mottoes, devices, buttons, etc., used especially by the United Gas Improvement Company were shown, and some account was given of the savings with respect to the money costs of accidents which their use as well as the use of preventive measures has accomplished.

The Electrical Development Movement

Mr. Henry L. Doherty, of New York, who returned from Europe on June 5, made a hurried trip to Chicago to address the association, on Friday morning, June 6, on the work of the Society for Electrical Development, of which he is president. He yielded, however, to Mr. James M. Wakeman, general manager of the society, who explained clearly the aims and plans of the organization. The whole object is to promote and increase the use of electrical energy by unified effort. Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, commended the movement heartily. All electrical manufacturers and operators should subscribe something. The campaign must have universal support and the expense should not be borne merely by a few large interests. He stated that the public-utility corporation is not understood in this country. Mr. Herr made a stirring appeal to central-station men for earnest co-operation.

Mr. Doherty, like Mr. Herr, was warmly applauded when he mounted the platform. He said that it would have been impossible for the National Electric Light Association to have undertaken the work which the Society for Electrical Development has essayed. In a few scattered places intensive development work is being carried on in this country, but these centers are not numerous. No central station is free from the effect of the development work of other companies. For instance, such work as that of Mr. Insull in Chicago benefits outside cities to which journals and newspapers go. It is surprising how many companies are doing nothing at all in this intensive development. Most of them do not know how to start. Here is where the new society can be useful. The success of the movement is assured, but the degree of success depends on the men represented in the National Electric Light Association. For every dollar collected and expended by the Society for Electrical Development the industry as a whole will receive back at least ten. The possibilities of the movement are boundless. Every family in the United States has an average latent capacity of spending $30 a year for electricity. The very considerable demand for the electric self-starters of gasoline cars was cited by Mr. Doherty as one of the possibilities of to-day. Give the little fellows a chance to come into the movement, said the speaker, and they will do so. In conclusion Mr. Doherty said to those who have faith in his work that he would promise that they would not regret it if they joined in the co-operative movement.

Constitutional Amendments

Four vice-presidents are now available at the right hand of the association's chief executive, a constitutional amendment adding two of these important officers to the executive staff having been passed at the final session. This insures enough executive officers to preside at all the various section meetings of the annual convention and provides a needed relief for the president in the performance of his duties.

An important constitutional amendment was also carried, dividing the association into seven classes, the change from the old order being made to permit the organization to take into membership individuals or companies outside of North America who may desire to keep in touch with association affairs. The dues are $20 per annum.

An amendment was also passed which is designed to secure to the *Bulletin* second-class postage rates, permitting either an increase in the size of this publication or reduced mailing expenses.

The Exhibition Committee

In selecting members for the exhibition committee, Mr. Charles Blizard, of Philadelphia, was named to succeed himself. Mr. J. W. Perry, of New York, was likewise put in nomination as his own successor, and Mr. John Mustard, of Philadelphia, was named to succeed Mr. F. N. Jewett, of St. Louis. In his annual report as chairman of the exhibition committee, Mr. J. C. McQuiston referred to the difficulties encountered by the exhibition committee in the basement of the Medinah Temple. At Seattle last year there were forty exhibits, covering 8000 sq. ft., while at Chicago there were sixty-two exhibits, covering 11,000 sq. ft. During the year Mr. Walter Neumuller resigned his position as secretary and treasurer of the committee. Mr. McQuiston devoted some attention to the representation of the electric industries at San Francisco in 1915, and said that he hoped some plan would be worked out whereby the various electrical societies may determine upon dates for holding conventions in 1915 which will make it necessary for many electrical men interested in more than one of the national societies to make only one trip.

The discussion at the meeting held by the Class D members on Thursday related principally to the 1915 exhibition. Messrs. James I. Ayer, of Cambridge, Mass.; H. I. King, of New York; H. G. McConnaughy, of New York; S. E. Doane, of Cleveland; C. P. Frey, of New York; George F. Parker, of New York; John F. Gilchrist, of Chicago, and others spoke on this subject. Mr. Ayer offered a resolution which was adopted, presenting the sense of the meeting that there should be a separate electrical building at the Panama-Pacific International Exposition in San Francisco in 1915. In relation to the grouping of dates for the electrical convention at San Francisco in 1915, Mr. Gilchrist was appointed a committee to take up the subject with other societies.

Award of Doherty Gold Medal

In its report at the closing session on Friday, the committee on award of the Doherty gold medal, of which Mr. W. F. Wells, of the Edison Electric Illuminating Company of Brooklyn, N. Y., is chairman, stated that during the year seventeen papers were submitted by six company sections, whereas the number presented last year was eighteen and the year before forty-six. The awards were as follows: The Doherty gold medal to Mr. P. F. Bludworth, Jr., of the New York Company Section, for his paper on "Adaptability to Service"; the Harriet Billings silver medal to Mr. Fred Willoughby, of the Denver Company Section, for his paper on "Contractual Relationship of Company and Customer," and a third prize of $25 to Mr. A. D. Bailey, of the Commonwealth Edison Company Section, for his paper on "Human Engineering." The prizes will be presented to the winners at the meetings of the respective company sections.

Executive Officers of National Body

On recommendation of the nominating committee, consisting of Messrs. Samuel Insull, of the Commonwealth Edison Company, Chicago; E. H. Davis, of the Lycoming Edison Company, Williamsport, Pa.; T. G. O'Dea, of the Erie County Electric Company, Erie, Pa.; Paul Doty, of the Edison Electric Light & Power Company, St. Paul, Minn., and Samuel Scovil, of the Cleveland (Ohio) Electric Illuminating Company, the following officers were elected at the closing session: President, Mr. Joseph B. McCall, Philadelphia Electric Company; first vice-president, Mr. John A. Britton, Pacific Gas & Electric Company, San Francisco, Cal.; second vice-president, Mr. H. Scott, of H. L. Doherty & Company, New York; third vice-president, Mr. E. W. Lloyd, Commonwealth Edison Company, Chi-

cago, Ill.; fourth vice-president, Mr. E. C. Deal, Augusta Railway & Electric Company, Augusta, Ga., and treasurer, Mr. W. F. Wells, Edison Electric Illuminating Company, Brooklyn, N. Y. The personnel of the executive committee is as follows: Messrs. W. C. L. Eglin, Philadelphia Electric Company, Philadelphia, Pa.; W. N. Ryerson, Great Northern Power Company, Duluth, Minn.; R. S. Orr, Duquesne Lighting Company, Pittsburgh, Pa.; H. C. Abell, American Light & Traction Company, Madison, Wis., and A. C. Einstein, Union Electric Light & Power Company, St. Louis, Mo.

THE PRESIDENT-ELECT

Mr. Joseph Benton McCall, the newly elected president of the National Electric Light Association, is and has been for years president of the Philadelphia Electric Company. He was born in New York City in 1870 and shortly afterward his parents moved to Philadelphia, where he received his education in the public schools and where afterward he began his business career in the law office of Rufus E. Shapley. His spare moments were spent in learning stenography and the rudiments of law. At the age of sixteen he entered the employ of the Pennsylvania Globe Gas Light Company, owned by the Elkins-Dolan-Widener syndicate. In a few years he became the company's secretary. Mr. McCall helped to organize the Pennsylvania Heat, Light & Power Company, formed in 1895 by Messrs. W. L. Elkins and Martin Maloney, and was its secretary and treasurer. The company was afterward absorbed by the Pennsylvania Manufacturing, Light & Power Company, of which Mr. McCall was made president, and when in turn that company was absorbed by the Philadelphia Electric Company, in 1899, he became executive head of the new corporation. He has devoted almost his entire attention to building up the great property, declining to take part in any outside organizations except in the case of the First National Bank of Philadelphia, of which he has been a director for several years, and the remarkable success of the Philadelphia Electric Company speaks volumes for his able management. Mr. McCall's judgment, business intuition and executive ability are of a high order, and his charming and democratic manner insures pleasant relations with all with whom he comes in contact. He is a firm believer in organization, a friend and counselor to his employees and maintains an excellent *esprit de corps* by promotions from within rather than by additions from without when vacancies occur. Mr. McCall was president of the Association of Edison Illuminating Companies from 1904 to 1907 and is a member of the American Institute of Electrical Engineers, the Franklin Institute and many of the prominent clubs of the Quaker City, namely, the Country, Racquet, Merion Cricket and Associates of Philadelphia. He is also vice-president of the Union League Club.

HYDROELECTRIC AND TRANSMISSION SECTION OFFICERS

At the session of the Hydroelectric and Transmission Section on Friday morning the following officers were elected: Mr. W. W. Freeman, Alabama Power Company, Birmingham, Ala., chairman; Mr. M. R. Bump, H. L. Doherty & Company, New York, first vice-chairman; Mr. I. B. Foote, Commonwealth Power Company, Jackson, Mich., second vice-chairman, and Mr. S. A. Sewall, N. E. L. A. headquarters, New York, secretary. The executive committee consists of Messrs. P. G. Gossler, A. B. Leach & Company, New York; P. T. Hanscom, Great Western Power Company, San Francisco, Cal.; D. L. Huntington, Washington Water Power Company, Spokane, Wash.; J. A. Lighthipe, Southern California Edison Company, Los Angeles, Cal.; D. B. Rushmore, General Electric Company, Schenectady, N. Y.; J. F. Vaughn, Stone & Webster, Boston, Mass.; A. S. Crane, J. G. White & Company, New York; R. D. Mershon, New York; F. B. H. Paine, Niagara, Lockport & Ontario Power Company, Buffalo, N Y.; H. T. Porter, Sanderson & Porter, New York, and P. M. Lincoln, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

COMMERCIAL SECTION OFFICERS

At the close of the meeting of the Commercial Section on Thursday afternoon the following officers and directors were nominated and elected: Chairman, Mr. T. I. Jones, Edison Electric Illuminating Company, Brooklyn, N. Y.; first vice-chairman, Mr. E. L. Callahan, H. M. Byllesby & Company, Chicago; second vice-chairman, Mr. Douglass Burnett, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.; secretary, Mr. J. F. Becker, United Electric Light & Power Company, Brooklyn, N. Y.; assistant secretary, Miss Gladys Burkhalter, N. E. L. A. headquarters, New York. The directors are: Mr. E. W. Lloyd, Commonwealth Edison Company, Chicago; Mr. T. I. Jones, Mr. Douglass Burnett, Mr. J. F. Becker, Mr. E. L. Callahan, Mr. C. A. Littlefield, New York Edison Company, New York; Mr. J. C. McQuiston, Westinghouse Electric & Manufacturing Company, Pittsburgh; Mr. F. H. Gale, General Electric Company, Schenectady; Mr. F. B. Rae, *Electric Merchandising*, New York; Mr. H. J. Gille, Puget Sound Traction, Light & Power Company, Seattle, Wash.; Mr. H. M. McConnell, United Gas & Electric Corporation, New York; Mr. L. R. Wallace, Edison Electric Illuminating Company, Boston; Mr. Joseph D. Israel, Philadelphia Electric Company; Mr. D. A. Gaskill, Greenville Electric Light & Power Company, Greenville, Ohio; Mr. H. N. Boynton, National Electric Lamp Association, Cleveland; Mr. W. E. Robertson, Buffalo, N. Y., representing the Electrical Jobbers' Association, and Mr. E. McCleary, Detroit, Mich., representing the National Electrical Contractors' Association.

ENTERTAINMENT FEATURES

The local committee provided abundantly for the entertainment of the ladies and delegates. On Tuesday afternoon there was a musicale, tea was served at the Blackstone Hotel, and on Tuesday night there was an elaborate circus and vaudeville entertainment given by the Commonwealth Edison Company Section of the N. E. L. A. and the Electric Club of Chicago in the main auditorium at Medinah Temple. On Wednesday afternoon excursions were made to the Hawthorne works of the Western Electric Company and to the Northwest generating station of the Commonwealth Edison Company. On the grounds at the latter station the baseball teams of the New York Edison Company and the Commonwealth Edison Company engaged in the annual game. Nine innings were played, and the score was six runs to zero in favor of the visiting team. On Wednesday afternoon there were also excursions to the hydroelectric plant of the Sanitary District, the electric freight tramways tunnels of the Chicago Tunnel Company and the stockyards. For the ladies who did not care to participate in any of these excursions tickets were provided for a matinee performance of the "Pageant of Darkness and Light" at the Auditorium Theater, and also to the exposition at the Coliseum. On Thursday an excursion trip was provided to the steel works of the Indiana Steel Company at Gary, Ind., and in the morning the visiting ladies were entertained by an automobile ride along the north shore of Lake Michigan. Luncheon was served at the Hotel Moraine. On Thursday evening all work was suspended so that nothing would interfere with the monster Jovian rejuvenation.

REJUVENATION OF THE JOVIAN ORDER

At least 1000 attended the rejuvenation at White City on Thursday night. The record of 176 candidates established at the Pittsburgh rejuvenation was beaten, more than 200 candidates being initiated at the White City gathering. After the rejuvenation the ardent adherents of Jovianism sat down in the Casino for supper and to witness a cabaret show which has seldom been equaled.

Southwestern Utilities Convention

Abstracts of several of the papers presented at the convention of the Southwestern Electrical & Gas Association, held in Galveston, Tex., on May 21, 22, 23 and 24, were given in our issue dated May 31. Other papers and discussions are outlined below.

Electric Railways

The opening session was devoted largely to electric railway matters. A paper entitled "A New Type of Concrete Track Construction" was presented by Mr. W. M. Archibald, of the Houston Electric Company; one on "The Use of Traffic Charts in Rush Service" was read by Mr. P. L. King, of the San Antonio Traction Company; Mr. C. O. Birney read his paper on "Old and New Ideas in Car Designs," and Mr. David Daly, of the Houston Electric Company, discussed the subject of "Street Railway Planning for Growing Cities."

Circuit Protection

Beginning with the Thursday morning session of the association, all papers and discussions dealt with subjects of especial interest to electric-service companies. The first paper to be read was that by Mr. E. E. Nelson, electrical engineer of the Northern Texas Traction Company, on the erection and protection of high-tension lines, which was abstracted last week. In reply to an inquiry, Mr. H. Jalonick, new-business engineer of the Texas Power & Light Company, Dallas, stated that men working on his company's 60,000-volt transmission lines were first required to ground the dead lines by means of chains. Replying to another question, he said that no special effort was made to ground the steel towers carrying this line. The tower legs were buried 6 ft. in the ground and set on concrete footings. The structure itself is a good conductor, being galvanized iron cold-riveted.

PRESIDENT-ELECT G. H. CLIFFORD

A question was asked as to the advisability of stepping down the voltage in high-tension lines within cities and increasing the size of the copper conductors. Mr. Nelson replied that objection to high-voltage lines in city streets is more a question of mind than one of fact. They will not kill a person any more quickly than the arc-lamp circuits and probably are safer, as partial leaks in high-voltage lines will clear themselves.

Mr. W. L. Wood, superintendent of the Texarkana Gas & Electric Company, emphasized the importance of the points brought out in the paper concerning switchboard wiring. The small operators should pay especial attention to this, particularly as regards the separation of various lines on the board. Crowded and improperly laid-out switchboards have been the direct cause of the destruction of entire plants. He said the faulty design is often due to the small operator's lack of competent engineers. In further support of Mr. Wood's suggestion, Dr. A. C. Scott, of the Scott Engineering Company, Dallas, said that too much stress cannot be laid on proper switchboard design. Conditions exist in many small plants that are very bad, but since no accidents have occurred no alterations have been made. As additional instruments and switchboard apparatus are required with the growth of the property, they have been added to the old panels, thus complicating the wiring and adding hazards to the board. Many boards are too close to the wall, making it practically impossible for a man to work behind them. A distance of 5.5 ft., in his opinion, is too close. It would be better to build an addition to the station than crowd the board.

Dr. Scott then took up the question of ground wires in high-tension circuits. He said that these wires can be placed too close or too far away from the transmission lines to accomplish the desired results. Further, he said it is a serious problem to protect against lightning discharges, which are notoriously freakish. The exact value of a ground line is unknown and proper insulation is most important. He said he would like to see something more done with glass insulators. Glass is more homogeneous than porcelain, which depends almost wholly on the glaze as an insulating medium.

Rate Making

"The Proper Basis for Rates for Electric, Gas and Water Public Utilities in Texas" was the subject of a paper by Mr. W. J. Norton, as abstracted in our issue last week. In reply to a question by Mr. W. B. Head, assistant general manager of the Texas Power & Light Company, as to the possibility of doing away with the demand rate, the author stated that he felt sure that the demand rate is equitable, but there is some question as to how far refinements should go in lighting. He said further that all companies should eliminate special rates. All rates should be fixed and published to obtain the best results.

Oil-Engine Operation

In the discussion of the paper by Mr. A. L. Chase on "Oil Engines for Light and Power Plants in Small Towns and Cities," abstracted last week, it was stated that the operating cost and depreciation per kilowatt with oil engines is quite low. Mr. Chase stated that unless an accident occurs the cost of maintaining an oil engine is considerably less than that required with a steam engine. Dr. Scott stated that the period of obsolescence is about the same as with other machines, 3 per cent being applied. As to the operators, no more intelligence is required to run an oil engine than a steam engine. It is merely a question of proper training.

Officers

At the general session Saturday morning the business of the association was transacted. It included reports of various standing committees and of the secretary and treasurer and the nomination and election of officers for the ensuing year. The newly elected officers for 1914 are as follows: President, Mr. G. H. Clifford; first vice-president, Mr. D. G. Fisher, assistant general manager Texas Traction Company, Dallas; second vice-president, Mr. W. L. Wood, Jr., general manager Texarkana Gas & Electric Company; third vice-president, Mr. C. W. Kellogg, general manager Beaumont & El Paso Railway Companies; treasurer, Mr. J. D. Walker, auditor Dallas Electric Light & Power Company; secretary, Mr. H. S. Cooper, Dallas.

The executive committee is composed of the following: Messrs. C. H. Clifford, Fort Worth; D. G. Fisher, Dallas; W. L. Wood, Texarkana; C. W. Kellogg, El Paso; F. M. Lege, Galveston; H. S. Cooper, Dallas; David Daly, Houston; F. J. Storm, Amarillo; F. B. Slater, Dallas, and W. B. Tuttle, San Antonio.

The newly-elected president of the association is vice-president and general manager of the Northern Texas Traction Company, Fort Worth, Tex., and general manager of the Fort Worth Southern Traction Company and of the Arlington Light & Power Company, which is engaged in the water, light and ice business at Arlington, Tex. He was born at Fort Worth in 1881. He graduated from the public schools and attended Weatherford College. After leaving school he worked as a stenographer for several companies until 1901, when he entered the service of the Northern Texas Traction Company as secretary to Mr. F. M. Haines, who was general manager of the company, owned by the Bishop and Sherwin syndicate, Cleveland, Ohio. In 1903 Mr. Clifford was made secretary and treasurer of the company, which position he held until 1905, when the property was purchased by Stone & Webster and he was made general superintendent.

ENTERTAINMENT

Friday afternoon was taken up with a boat-ride excursion to Galveston jetties and Bettison's Pier, where a fish supper was served by the supply men who are members of the association. Friday night was set aside for the Jovian parade, full rejuvenation supper and speeches, and a class of ninety new members was initiated at the Scottish Rite Cathedral. Fred Johnson, Wagner Electric & Manufacturing Company, St. Louis, acted as toastmaster, and the speakers of the evening included F. E. Watts, reigning Jupiter, New York; W. B. Head, Dallas, and Sam A. Hobson, Chicago.

Other entertainment features included surf bathing, free tickets being provided, a band concert and parade of United States troops at Fort Crockett, an open-air concert and dance at the Garten Verein, a German club, luncheon for the ladies at the Oleander Country Club, a boat ride in Galveston harbor and an auction bridge party for the ladies.

Merger of Louisville Public Utility Properties

By far the most important happening in electric circles in Louisville during the past week, not to mention the interest felt in the matter by the general public, was the handing down of the decision of the Kentucky Court of Appeals to the effect that the merger ordinance recently passed by the Louisville City Council permitting the consolidation under one ownership of the various electric and gas companies doing business in Louisville was legal and valid and that the consolidation could proceed.

This decision removes the last obstacle in the way of the proposed merger, which is to be accomplished by the Byllesby interests, and all that remains now is to perfect the details, which, of course, are considerably involved in view of the number of plants to be taken over and the various rearrangements which will be necessary in order to get the new organization into working order.

As heretofore indicated, the principal reason for the city's willingness to concede a practical monopoly in the light and power field in Louisville was the promise of the Byllesby company to bring natural gas from West Virginia to the city and sell it to consumers at low cost, and the ordinance was passed with a provision to this effect, fixing rates on a sliding scale and providing that when the natural gas became exhausted the Council should fix the rate for manufactured gas.

Other provisions were inserted in the ordinance for the protection of consumers, which, under the Kentucky law, merely provided for the sale of a franchise to the highest bidder. The prevailing low rates in the city as a result of the keen competition prevailing between the Louisville Lighting Company, controlled by the Byllesby interests, and the Kentucky Electric Company, which is to be taken over by them, could not last, and this was generally realized. The prices fixed under the ordinance providing for the sale of new franchises regulate the matter in a manner satisfactory to the city and fair to the company.

It is planned to organize an eighteen-million-dollar corporation to take over the various plants which will be included in the Louisville Gas & Electric Company, as the consolidated concern will be called. So far the only officers announced are General George H. Harries, now the head of the Louisville Lighting Company, as president, and Mr. Donald McDonald, president of the Kentucky Heating Company, as vice-president and general manager. Other officers will be announced later.

Public Service Commission News

CALIFORNIA COMMISSION

The Pacific Gas & Electric Company has applied to the Railroad Commission for a certificate of public convenience and necessity for the construction of three additional power plants on the extension of Bear River, Placer County, and the construction of a transmission line from the Bear River development to Nicolaus, in the Sacramento Valley. The applicant stated that the construction would provide for 35,000 hp, at a cost of $2,396,000.

A supplemental decision was rendered by the Railroad Commission on May 14 providing that the Northern California Power Company should make returns to its patrons of all money previously collected in excess of the established rates.

NEW YORK COMMISSIONS

The Public Service Commission for the First District has dismissed the complaint of Frankel Brothers against the New York Edison Company. Frankel Brothers maintain a private electric plant and have a contract with the New York Edison Company to provide break-down or auxiliary service at times when their private plant is either not in operation or unable to supply all the energy needed. After this contract was made Frankel Brothers began to supply energy from their private plant to the Phipps Tenements, a building immediately south of their building. The Phipps Tenements discontinued the Edison service in order to take the service supplied by Frankel Brothers, which was provided at rates 15 per cent lower than the schedule of the Edison company. The Edison company then canceled its contract for break-down service with Frankel Brothers. The latter immediately filed a complaint with the commission asking that the company be required to continue the service. The commision found that the Edison company's contract with Frankel Brothers provided that the installation should not be increased except with the written consent of the company; that no consent had been obtained, and that therefore the company could not be compelled to continue the service.

INDIANA COMMISSION

The Indiana Public Service Commission has been asked to authorize the sale of the People's Light & Heat Company of Indianapolis to the Merchants' Heat & Light Company of that city and to grant the latter company permission to increase its capital stock from $1,250,000 to $1,500,000 and to issue $325,000 of 5 per cent bonds. The consideration asked for the People's property is $525,000. This company has for the last six months been owned by the American Public Utilities Company, which also owns the Merchants' company, so that the present proposed sale amounts to little else than a rearrangement of operating organization. The Merchants' company has been selling electricity to the People's system since Oct. 1. From Oct. 1 to May 1 the latter's gross earnings were $94,870.48. For the same period the operating expenses were $62,649.51 and the net earnings $32,220.97.

Current News Notes

Municipal Ice Making.—Serious consideration is being given to the proposal that New York City enter into the manufacture of ice not only for the municipal departments but also for distribution at cost in the crowded districts. Omitting such items as building rental, taxes, overhead charges and salaries of officials, it is estimated that ice can be produced in connection with the generating plant at the Hall of Records for $1 per ton. An appropriation of $40,000 has been approved for purchasing refrigerating apparatus for the experiment.

* * *

Wireless Telegraphy for Pennsylvania Railroad.—According to newspaper reports, the Pennsylvania Railroad Company is planning to supplement its present system of communication with a system of wireless telegraphy for use whenever the aerial lines are out of commission. Doubtless the basis for these reports is a proposition made by the Marconi Wireless Telegraph Company to install without charge wireless apparatus in stations erected by the railroad company with a view to determining the possibilities of wireless telegraphy in railway service. It is expected that an appropriation will be made for carrying on the initial experimental work.

* * *

The Lady Manager from Arkansas.—Among the delegates to the Chicago N. E. L. A. convention was Mrs. La Salle Stoops, general manager of the Stuttgart (Ark.) Water & Electric Light Company, who has the distinction of being one of the few women operators of electric-lighting plants in the world. Mrs. Stoops has active charge of all matters of operation, purchases, contracts, etc., in connection with her 200-kw station, which supplies the city of Stuttgart with both its electricity and water. At the recent Little Rock convention of the Arkansas Association of Public Utility Operators, before which she read a paper on her experiences as a manager, Mrs. Stoops was elected special delegate to the national convention with all her expenses paid.

* * *

Copper Plaque to Mr. Walter Neumiller.—At the business meeting, June 5, of the Class D members of the National Electric Light Association who had exhibits at the Chicago convention a handsome copper plaque was presented to Mr. Walter Neumiller, of the New York Edison Company, in token of the exhibitors' appreciation of his important services in past exhibitions as secretary of the exhibit committee. Following is the inscription on the gift tablet: "As an expression of our sincere and lasting appreciation of the unceasing efforts on the part of our secretary, Walter Neumiller, which have given the annual exhibits of the Class D members a new and broader significance and an increased value to the membership at large, this testimonial is presented by the exhibition committee of the National Electric Light Association."

* * *

SOCIETY MEETINGS

Electrification and City Planning.—Electrification of railway terminals was shown to conform with the "Chicago Plan," by Mr. Eugene Taylor, of the Chicago Plan Commission, in a lecture delivered at the Electric Club of that city on May 29. Mr. F. A. Delano, president of the Wabash Railroad, will speak on city planning at some future meeting of the club.

* * *

New York Electrical Society.—A meeting of the New York Electrical Society was held in the Academy Room of the American Museum of Natural History on May 30. Prof. Harry Fielding Reid, Johns Hopkins University, lectured on "The Seismograph and Its Revelations." The lecture was illustrated with lantern slides and practical demonstration of the working of the seismograph belonging to the New York Academy of Sciences.

* * *

Meter Committee of Ohio Association.—At Dayton, May 22, the meter committee of the Ohio Electric Light Association held its final meeting before the Cedar Point convention, July 15 to 18, where it will present a comprehensive report on meter practice. During the last year the meter men's section of the association has been holding informal meetings at intervals in various Ohio cities. All meter men within a radius of 50 miles are invited to attend these sessions and to take part in the practical discussions which characterize them.

* * *

Philadelphia Company Section, N. E. L. A.—The following men have been elected officers of the Philadelphia Electric Company Section of the National Electric Light Association for the ensuing year: Mr. Joseph B. Seaman, chairman; Mr. William B. Ahern, vice-chairman; Mr. Frank A. Birch, secretary, and Messrs. B. Frank Day, H. R. Liversidge, James T. Maxwell and Fred Zoller, executive committee. Mr. Louis A. Schulze has been elected chairman and Mr. Joseph G. Johnson secretary of the meter department branch of the section; Mr. John F. Fork is the new chairman and Mr. Francis Jones the new secretary of the accounting department branch, while Mr. George G. Findley is the newly elected chairman and Mr. Edward J. Walsh has become the secretary of the commercial department branch.

* * *

Eastern New York Section, N. E. L. A.—At a meeting of the Eastern New York Section of the N. E. L. A. held at Poughkeepsie on May 28 the subject of rural installations, switching and protection was discussed by Mr. E. B. Merriam, who dealt with farming and dredging equipments, harvesting machines, etc. Prof. E. E. F. Creighton spoke on the subject of protection, showing by means of lantern slides the various types of lightning arresters, arcing ground suppressors and other devices particularly suitable for substations for rural distribution. The two papers were discussed by Mr. A. T. Throop, of the Utica Gas & Electric Company; Mr. Leon Scherck, of the Central Hudson Gas & Electric Company; Mr. H. W. Peck, of the Schenectady Illuminating Company, and others. At a meeting of the executive committee plans for a midsummer annual meeting were discussed, and arrangements will probably be made for a meeting in July or August.

* * *

Spokane A. I. E. E.—At the regular May meeting of the Spokane (Wash.) Section of the American Institute of Electrical Engineers, held in the Hotel Spokane, officers for the ensuing year were elected as follows: Mr. J. B. Fisken, chairman; Mr. J. W. Hungate, vice-chairman; Mr. H. B. Peirce, secretary-treasurer; Messrs. S. C. Gates, C. F. Uhden, L. N. Rice and V. H. Greisser, executive committee. A paper was read by Mr. Ray Plank, of the Home Telephone Company, on "Small Magnet Winding, Theory and Practice," and Prof. H. V. Carpenter, of Washington State College, presented a paper entitled "An Exact Formula for Determining the Regulation of Long Transmission Lines." The last paper of the evening was by Mr. R. F. Robinson, of the Pacific Telephone Company, on "Transposition of Telephone Lines." Each paper was fully discussed by a number of speakers, it being the aim of the section to have relatively short papers followed by ample discussion. During the summer the entertainment committee will make arrangements for a series of trips to points of interest in the city and to plants in the vicinity, regular meetings being discontinued.

N. E. L. A. Convention Papers and Discussions

Abstracts of addresses made and reports and papers read at the thirty-sixth annual convention, held in Chicago from June 2 to 6, 1913—Exhibit by Class D members

ON a preceding page is an account of those features of the thirty-sixth convention of the National Electric Light Association, held at Chicago, June 2 to 6, which are of general interest from the point of view of their news value. Below and on the following pages are given abstracts of the papers and committee reports presented during the convention, together with an account of the discussions which they occasioned. These abstracts and discussions, it will be noted, are arranged according to subject matter, without regard to the order of their presentation in the sessions or the section of the association before which they were discussed.

PROGRESS REPORT

In his report as the committee on progress, General Secretary T. C. Martin paid considerable attention to the unification of supply of energy over large territories and to legislation and commission rulings that have been made in recognition of the changing conditions in energy-supply undertakings. Relations between the central stations and the public, and between the companies and their employees, were well discussed. Among the newer fields of activity to which attention was particularly directed were the electric vehicle, refrigeration and agriculture. Many of the data presented related to the recent work around Chicago, in which city the association was organized thirty years ago.

PUBLIC POLICY

The report of the public policy committee, signed by Mr. Arthur Williams, as chairman, and by Messrs. N. F. Brady, Everett W. Burdett, H. M. Byllesby, Henry L. Doherty, Charles L. Edgar, W. W. Freeman, George H. Harries, Samuel Insull, Joseph B. McCall, Thomas E. Murray, Samuel Scovil, Charles A. Stone and Frank M. Tait, ex officio, is in itself compact, but added to it are appendices relating to: (1) the service annuity plan of the Edison Electric Illuminating Company of Boston, (2) welfare work of the Public Service Corporation of New Jersey, (3) decision of the Supreme Judicial Court of Massachusetts in the case of the Fall River Gas Works Company versus the Board of Gas and Electric Light Commissioners, and (4) the decision of the Railroad Commission of Wisconsin in relation to electric-service rates in Milwaukee.

The committee believes that where a given territory is occupied by an electrical corporation rendering good service at fair prices, treating its employees fairly and otherwise holding itself in alignment with the public interest, it should be protected against "raiding" or destructive competition. The natural and proper tendency of the industry is toward a regulated monopoly. One of the advantages to be gained is a unified system of enhanced capacity, which as a result is capable of rendering better and cheaper service. Anything which seeks to disturb this condition is not in the interest of the public, either that part served by the corporation or that holding its securities.

As in earlier reports, the committee expresses its gratification that the National Electric Light Association and the industries it represents have been leaders in welfare work.

So far as the committee can learn, the plan for minimum wage has been carried out without complications or labor disturbance or seriously objectionable increase in the cost of manufacture. The results seem to have been beneficial and the committee repeats that the industry must suffer if its employees are inadequately compensated. It urges the care of employees as a definite responsibility and says that nothing to insure a healthy, contented and well-trained human organization in a public utility industry should be left undone.

Prevention rather than cure should be the attitude of the industry toward questions of safety and sanitation. Accidents entail loss upon the public as well as upon the company and its employees, and in the end the public pays the cost of all industrial accidents. In relation to sanitation, the committee points out the importance of providing pure drinking water at a proper temperature. This is spoken of as an economic necessity. A note of warning is sounded in relation to the methods followed by some of the casualty corporations in adjusting claims of injured employees. It is urged that members using this insurance shall themselves see to it that their employees receive fair treatment. On this subject the committee adds: "Undoubtedly a great deal of present-day antagonism toward capital on the part of industrial workers and a large percentage of the public is due to the harsh, indifferent and, we fear, sometimes unlawful manner in which injured employees and their dependents have been deprived of the compensation to which they were justly entitled. This wrong should be righted at any cost."

Under the head of "Important Commission and Court Decisions" the committee lists the recent commission decision in New Jersey in relation to the rates of the Public Service Gas Company; the New York Second District Commission's decision in the matter of complaint of the city of Buffalo against the Buffalo central-station companies, reducing rates from 25 to 28 per cent; the decision of the First District Commission of New York reducing gas rates of the Kings County Lighting Company (in this case the Appellate Court has reversed the order of the commission); the Des Moines gas case; the decision of the Maryland Public Service Commission reducing rates of the Baltimore company, and, one of the most important, the decision of the Supreme Judicial Court of Massachusetts in the case of the Fall River Gas Works Company against the Board of Gas and Electric Light Commissioners. This last decision is reproduced in full in the appendix. A decision of the Wisconsin commission in relation to electric rates in Milwaukee is reproduced practically in full in the appendix.

A renewal of the tendency toward municipal ownership and operation of public utilities seems imminent, in the judgment of the committee. The Socialist party is making special efforts in this direction, and where members are threatened with competition of this character they are urged to get in immediate touch with the officers of the association. In relation to the state-wide scheme of hydroelectric development in New York, the committee says that it is "perhaps the most serious and destructive activity of the moment." The bill providing this plan was passed by the Legislature but vetoed by the Governor, the public policy committee taking part in an educational plan of opposition.

The committee commends the recent movement which has resulted in the organization of commercial educational courses and in summing up calls attention to the serious

state of public unrest here and abroad. Much good, it says, will be accomplished in continuing the policy of the past of approaching these problems in a spirit of earnest interest, fair play, good will and sincere regard for those associated with the central-station interests in the conduct of the industry.

Resuscitation from Electric Shock

The report of the commission on resuscitation from electric shock, presented by Past-president W. C. L. Eglin, reviewed exhaustively the work of the commission, with a discussion of the relative merits of the Silvester and Schaefer manual methods of artificial respiration. An important feature of the report was a critical analysis of the claims made for the pulmotor as an efficient mechanism for reviving unconscious subjects and an outline of the mechanical method of artificial respiration by pharyngeal insufflation as developed by Dr. S. J. Meltzer, head of the department of physiology and pharmacology in the Rockefeller Institute for Medical Research.

The commission concedes that the Schaefer method is superior to the Silvester through its greater simplicity and ease of performance, absence of trouble from the tongue falling back and blocking the air passages and reduced danger of injuring the liver or breaking the ribs in the application of pressure. Observations indicate that, so far as the amount of ventilation of the lungs is concerned, the Schaefer method, reinforced by the extension of the arms forward, is decidedly better than that suggested by Silvester. This advantage, taken in conjunction with its greater simplicity and safety, caused the commission to vote unanimously in favor of the prone-pressure method of artificial respiration as an effective means of giving immediate aid. Reference was made to the commission's booklet on resuscitation, which has been prepared as the outcome of the work.

Even a relatively poor method of artificial respiration, if begun immediately, may maintain life and permit ultimate recovery in cases in which an ideal method, with all the resources of the laboratory and hospital, would be ineffective after a few minutes. In order to test the action of devices now being advocated, a sub-committee, with Dr. Meltzer as chairman, was appointed. The apparatus examined was used according to directions, and the effects were demonstrated before the members of the committee. At least four machines for performing artificial respiration are now in the market—the pulmotor, the Du Brat apparatus, the "lungmotor" and the "salvator." The last two devices were not examined. The apparatus of Du Brat seems never to have become a successful commercial article. The committee emphasizes the wide publicity which the pulmotor has received through the daily press, but points out at length that the pulmotor has lacked scientific, surgical and medical sponsors. Efforts to obtain scientific details and other reliable information bearing upon specific cases in which the pulmotor has been used lead to the conclusion that the cases available to the committee do not furnish convincing proof of the necessity or exceptional value of this apparatus. The committee agrees that the instrument is probably capable of creditable performances and doubtless has in some instances favored the restoration of normal breathing. Its present vogue, however, is not supported by a critical examination of the principles involved in its mechanism or of its effect when used for long periods. No well-considered testimony as to its action is to be found in medical literature, and in this country at least its loudest sponsors are the newspapers, which have spread the impression that the pulmotor is a perfect resource when inspiration is suspended. In view of the facts obtained by study of the Du Brat apparatus and the pulmotor, the members of the sub-committee agreed upon the following suggestions: In cases without any respiration the pulmotor should be used only when guided by hand and then not faster than twelve to fifteen complete respirations per minute; when left to run automatically it is liable to be inefficient and dangerously deceptive. Because of suction on the lungs neither the pulmotor nor the Du Brat should be used for more than five or six minutes at a time, and if nothing better is available should be alternated with the Schaefer method combined with oxygen inhalation. In cases of slow and stertorous breathing, however, both machines can probably be used for a longer time with benefit and without danger.

The remainder of the report describes the mechanical method of artificial respiration used by Dr. Meltzer, based on pharyngeal insufflation. The apparatus which Dr. Meltzer has devised has the following commendable features: (1) Its positive action is determined by the operator and not left to a mechanism which may fail to work; (2) it is free from a sucking action during expiration, as the latter results from the natural recoil of the disturbed parts; (3) it is light; (4) it is relatively inexpensive; (5) it is simple, and (6) it embodies in a form which can be used by laymen a method of artificial respiration which has been employed for many years in scores of laboratories and on thousands of animals and is known to be effective and free from danger. The commission recommends this apparatus as a satisfactory means of continuing artificial respiration and suggests that in cases of suspended breathing the modified prone-pressure method be supplemented as soon as possible by the use of the apparatus.

Generation and Transformation

Prime Movers

The committee on prime movers, through Chairman I. E. Moultrop, of the Edison Electric Illuminating Company of Boston, submitted a 100-page report covering the development of water, steam and gas units during the past year. It was stated that there has been no striking development in any of the various forms of prime movers applicable to central-station use. However, much thought has been given to improving the efficiency of waterwheels and steam turbines, and an earnest effort has been made to develop an internally fired heavy-oil engine. Considerable attention has been devoted to boilers and boiler rooms with a view toward raising their efficiency.

Of the water-power units the vertical turbines seem to be most in favor at present owing in large measure to the improvements made in thrust bearings. The Kingsbury thrust bearing and the combined oil-pressure and roller form of bearing have been reported to give excellent results in operation. Optimistic letters from the General Electric Company and the Westinghouse Machine Company published in full in the report show that the trend of rotative speed in steam turbines is upward and that the several minor changes that have been made in design have helped to improve the efficiency. Steam turbines for driving station auxiliaries are reported to be bidding fair to supersede all other competitive apparatus. Curves submitted in the report show the relative steam economy of this type of auxiliary as compared with the high-pressure reciprocating steam engine. In connection with high-pressure turbines the committee called attention to the statement of Dr. S. Z. Ferranti, who has said that he expects soon to be able to produce a high-superheat turbine capable of operating on less than 6 lb. of steam per steam brake-horse-power-hour.

Reports from manufacturers show that at present there seems not to be a sufficiently active demand in this county for the high-efficiency, self-contained steam units, such as the Lentz, Wolf and Locomobile types, to warrant their construction.

Condensers are sometimes built following the design of

a steam boiler, the designer apparently being under the impression that the greater the number of times the steam in its passage through the condenser can be brought into contact with the tubes the greater will be the amount of heat extracted. It was the suggestion of the committee that when designers realize that exhaust steam has not the same characteristics as flue gas, and that a condenser should be designed to get the steam to and not through the cooling surface, condenser tubes will be located far enough from the last row of buckets to permit the steam to free itself from the last row of blades without encountering a decided back pressure at that point.

In answer to a circular letter sent out by the committee information of general interest was obtained bearing on the following subjects: new methods and devices, flow meters and forced draft, feed-water heaters and feed-water heating, deterioration of steel stacks, and trouble with turbine blades. The statistics obtained from the answers to the letters were given in full in the report.

The question of adequate opening for admitting air for draft to boiler houses led to calculations with rather startling results. It was stated that if in an assumed boiler room containing twenty 500-hp boilers the air for the draft was compelled to enter through a 7-ft. by 7-ft. doorway the velocity of the blast would reach 50 miles an hour. These figures were presented as an argument for adequate draft opening both in winter and summer.

The data which the committee has been able to present on the operation, accuracy and value of apparatus for determining flue gas composition seem to indicate a wide divergence of opinion among the companies using this apparatus. It is the opinion of the committee that a steam-flow meter can perform essentially all of the functions claimed for the CO_2 meter.

Because of the high calorific value of petroleum oil and its great adaptability to boiler work it is almost the ideal fuel. The comparatively recent discovery of oil fields in Mexico is looked upon as an important factor in the production of this fuel. It is of interest to note that steam atomizer burners have now been so developed that they will operate on from 1 per cent to 2 per cent of the amount of steam generated by the boiler which they serve. The rating of a good steam atomizer burner is now placed at 400 boiler hp and it is possible with such burners to operate a boiler at from 200 to 450 per cent of its rating.

A recent type of stoker combining the best feature of inclined underfeed and overfeed stokers and shaking grates is claimed to have developed from 200 per cent to 250 per cent boiler rating with an efficiency of from 75 per cent to 77 per cent. The power required to operate the stoker was 1.5 hp, and 20 hp was used for driving the blower.

The committee in presenting for discussion the term "myriawatt" in an effort to get rid of the term boiler-horse-power suggested that the question of adoption of such a unit be put into the hands of the national engineering societies.

In the report on gas power it was stated that the market for gas and oil engines had been unusually quiet in the past twelve months and this was attributed to the great trend toward the centralization of generating stations. Owing to the relatively large investment and maintenance cost even the smaller units have suffered a loss in the prestige accorded them by the industries a few years ago. There were included in the report interesting statistics regarding the general oil supply and a review of prices here and abroad. There are approximately 300 installations of medium and heavy-duty oil engines, aggregating 75,000 hp, in operation in the United States, indicating that the oil engine has assumed a definite part in the production of this country.

Although no gas turbine has yet been developed, engineers engaged in the development of the internal-combustion engine have long realized the advantage of substituting rotary movement for reciprocating motion. So far practical difficulties have not been surmounted. Much useful knowledge, however, has been obtained by able experimenters, and with some additional experimental data which are now at hand the difficulties will be considered afresh.

A paper by Lieutenant W. W. Smith, United States Navy, appended to the report gave a general description of the Kingsburg thrust bearing and a more particular description of the thrust bearing on the U. S. S. *Neptune*, which is of this type. An appended paper by the Allis-Chalmers Company signed by Mr. W. M. White gave a description of the company's practice in the construction of waterwheel runners. A letter from the I. P. Morris Company signed by Mr. H. B. Taylor discussed the merits of the built-up waterwheel runner. Viele, Blackwell & Buck, through Mr. F. O. Blackwell, stated in a letter on waterwheel runner material that in general it is evident that runners of bronze and cast steel are less liable to breakage than cast iron, that bronze and cast iron have the advantage of giving better castings than steel and that their data show little choice between bronze cast steel and cast iron as far as cutting from sand is concerned. Mr. Chester W. Larner, of the Wellman-Seaver Morgan Company, discussed at some length the advantages and disadvantages of the built-up runner and commented upon the qualifications of different runner materials.

A letter from the Ontario Power Company signed by Mr. V. G. Converse stated that in the writer's opinion for medium and high heads bronze runners gave the best service. A paper by Prof. C. M. Allen, of the Worcester Polytechnic Institute, published in Appendix C of the committee's report, gave data and opinions on efficiency tests of waterwheels after installation.

Appendix D contained a letter from the Wellman-Seaver Morgan Company, in which the Johnson type penstock valve was described and illustrated. Mr. Arthur D. Pratt, of the Babcock & Wilcox Company, prepared an interesting paper which was appended to the report, on "Oil Fuel and Its Combustion." In this paper the calorific values of various oils were given and the advantages of coal and oil were compared. Oil burners were described and data given as to their operation.

Specifications for internal-combustion engine fuels were printed in Appendix F, the data there given being reprinted from the writings of Mr. Irving C. Allen and Dr. Rudolph Diesel and from the German Tar Production Trust at Essen-Ruhr. The gas-power situation in Europe was discussed in a report by Mr. H. J. K. Freyn, construction engineer for the Allis-Chalmers Company, an abstract of this report being included in Appendix G.

Discussion

Mr. W. L. Abbott, Commonwealth Edison Company, Chicago, called attention to the recent order of a 30,000-kw steam turbine for the company's service as evidencing the rapid progress of the art even in the brief interval since the prime movers committee report was prepared about three months before.

Mr. I. E. Moultrop, Boston, Mass., closed the consideration of this paper by reading a letter from the General Electric Company which stated that the braking of the turbine diaphragm nozzles mentioned in the report was not due to their having been cast in solid with the diaphragms, but to the fact that 30 per cent nickel steel was used in the partitions, instead of 3½ per cent nickel steel. Where the cast-in nozzle type of machine is used the smaller percentage of nickel is desirable for the partitions. A removable nozzle has been developed for some of this manufacturer's turbines, and in replacing broken nozzle diaphragms, the removable-nozzle feature has been applied where the customer has considered this feature worth the additional price.

Operation of Water-Power Systems

The committee on operation of water-power systems, the chairman of which was Mr. David B. Rushmore, of the General Electric Company, presented an exhaustive report on its investigations. The general layout of systems received considerable attention and separate sections were devoted to each class of apparatus employed in the operation of hydroelectric systems. The committee contended that in order to be able to furnish reliable service consideration should be given to the cause of disturbances and the means for minimizing their effects, and its report contained recommendations to that effect.

The planning of a hydroelectric system begins with the consideration of the proper number of generators, transformers and outgoing lines, and when deciding on these the methods of operation of the system as a whole should be kept in mind. With units of large capacity and with several power stations tied into the same system, unusual precautions must be taken to prevent the concentration at points of trouble of too great amounts of energy, and thus the use of artificial and inherent power-limiting reactors becomes an important factor. By a large majority high-voltage systems are really distributing rather than transmission systems, so that one of the principles involved is to localize the disturbance and isolate it quickly.

No hydroelectric development should be provided with an equipment of apparatus above the rating at minimum stream flow unless there is an auxiliary steam station. The steam station may serve any one or all of three purposes—first, that of an auxiliary station to be used at periods of low water; second, that of a reserve in case of interruptions, and third, that of a regulating station to take care of the variations in the load with a hydroelectric plant run at constant output.

In the several chapters of the report treating of different classes of apparatus such as waterwheels, generators, exciters, transformers, etc., reference was made to the latest developments within each particular field and there were recommendations in regard to different types to be used under various conditions.

The transmission and distribution lines had very careful consideration by the committee, this part of a system being considered the weakest link in an installation. It is not considered wise to depend entirely upon a single circuit to transmit the output from an important station. The same weight of copper divided into two circuits and supported by slightly modified towers would considerably reduce the chance of shut-down with only a moderate additional cost for towers, a second set of insulators and labor for erecting the second circuit. The overhead ground wire is considered of undoubted value for lightning protection, and better results may be expected from two circuits than with one. These wires should be placed as far above the transmission lines as practicable and with a minimum shade angle of 45 deg.

For high-voltage transmission lines suspension insulators are now used exclusively, the practical limit of the pin-type insulator being approximately 60,000 volts. For transmission voltages higher than are used at present the design of the suspension insulator must necessarily be modified so that the potential along the string can be better distributed. A liberal factor of safety should be allowed in selecting line insulators, as they form only a small part of the total cost of the line and are the most vital factors in its success. With great improvements in high-tension insulators the patrol of transmission lines has been very much reduced and a greater importance should be attached to the ability to locate the particular points of the line in trouble and to get a repair man there at the earliest possible moment.

Line inspection at night has also been made possible by the use of searchlamps. Arrangements are often made with residences near the lines for reporting trouble. It seems to be the general belief that as a general rule rewards should not be offered for such services. Such services should, however, always be acknowledged by a letter of thanks or otherwise.

Discussion

Mr. F. B. H. Paine, of the Niagara, Lockport & Ontario Power Company, suggested the desirability of utilizing hydroelectric plants for auxiliary service on peak loads, especially where the water supply is limited and the cost of development is not far from $70 per kilowatt.

Electrical Apparatus

In a forty-eight-page paper the committee on electrical apparatus, of which Mr. L. L. Elden, of the Edison Electric Illuminating Company of Boston was chairman, reported upon the progress made and the tendency of developments of electrical apparatus for use in central-station service. It was stated that more attention than ever before is being given to details that will insure satisfactory operation. With the continuation of the tendency of manufacturers toward units of greater rating, higher relative speeds are being adopted, thereby necessitating the use of improved types of insulating materials suitable for withstanding high temperatures and severe mechanical strains. As is to be expected, sizes and ratings of switching units and other station accessories are growing apace with the generating units. In the appendix to the committee's report the various electrical apparatus applicable to central-station work were treated. A general summary of these topics is given in the following paragraphs.

The past year has been marked by progress in the design of turbo-generators and it was reported that several companies have placed orders for 25,000-kw units. Manufacturers now indicate their ability to build large high-potential generators without employing auto-transformers.

Reactors are used for protection against high-frequency disturbances, for voltage regulation and synchronizing machines, and to limit current rushes into a short-circuit. With the latter class practice is still somewhat in the evolutionary stage with respect to standards, but their use with such apparatus as generators and transformers, for insertion on busbars of substations and in feeders is becoming more widespread.

With regard to the higher speeds of rotative apparatus instances were cited in which 5000-kw units operate at 3600 r.p.m., 19,000-kw units at 1875 r.p.m. and 20,000-kw units at 1500 r.p.m., and it is apparent that the final limit has not yet been reached. The adoption of commutating poles has assisted materially in making it possible to develop high-speed apparatus, and 25-cycle machines of recent design are now operated at approximately twice the number of revolutions of the old non-commutating-pole designs, although peripheral speeds have not increased in the same proportion.

There seems to be a tendency at present to equip generators with directly coupled exciters. Chief among the advantages of this idea are: simplicity, economy and elimination of wiring and switching connection.

In spite of the fact that the rotary converters of recent date show greater speeds and increased outputs due to inauguration of commutating poles, the committee believed that proposals to change over existing rotary converters should generally be discouraged. Only in special cases should the change be considered and then with due regard to cost and complications to be overcome. In summing up the situation the committee recommended the use of 60-cycle machines for railway service.

A table of comparisons, which shows at a glance the relative merits of the motor converter, a device for the conversion of alternating current to direct current, rotary converters and their transformers, and motor-generators, indicates that the motor converter may in the future be an active competitor in the converter field.

The use of synchronous converters for securing better regulation on transmission lines and for correcting the power-factor on distribution systems was commented upon, and although in the former case installations have met with much success, it was the opinion of the committee that other methods should be employed for power-factor correction.

Recommendations have been made by the committee to the A. I. E. E. committee on standards with regard to the quality of insulation. Upon the completion of the A. I. E. E. committee's exhaustive study of this subject it is expected that some definite recommendations will be made which will serve as a guide to both manufacturers and operators.

Improvements in the construction of rheostats were discussed by the committee with special reference to operating troubles occurring with this type of apparatus among the companies during the past year.

The data concerning the application and operation of types of brushes on commutating apparatus which were presented were said to be authoritative and accurate. The hard-carbon brush, treated hard-carbon brush, graphite brush and copper graphite brush were mentioned in connection with the class of operation to which they are best suited.

Investigation of the merit of outdoor transformer installations reveals certain advantages and disadvantages compared with the indoor station. The advantages of the outdoor station are lower first cost, extension made at less cost, reduction of fire risk and more efficient cooling of air-blast transformers. The disadvantages are trouble from moisture, interference from outside parties and difficulty in repairing and handling apparatus in bad weather. The committee recommended careful consideration of the means of supplying economical service under favorable conditions. Oil switches, feeder regulators, electrolytic lightning arresters and other auxiliary apparatus commented upon show improvements in details which add to the efficiency and reliability of the plant in general.

Discussion

Mr. R. F. Schuchardt, Chicago, said that the 30,000-kw generator for the Commonwealth Edison Company will operate at 1500 r.p.m., delivering energy at 9000 volts without auto-transformers. About half the reactance will be in the machine itself and half in external coils, an arrangement which tends to increase the efficiency about two-thirds of 1 per cent. In the near future the limit of generating capacity per section of the Chicago central-station system will probably be raised from 60,000 kw to 100,000 kw. Regarding noise in substations, Mr. Schuchardt cited the replacement of a frequency changer with transformers as an effective measure. He also mentioned the tendency to supply an exciter on the generator shaft in large units for central-station service.

Mr. Philip Torchio, New York, favored the use of external reactance coils in connection with large turbo units. The bus tie reactances mentioned in the report should have the full carrying capacity of the switch between bus sections. Reactances between parallel operating stations are as important as between bus sections.

Messrs. I. E. Moultrop, Boston, Mass.; E. A. Lof, Schenectady, N. Y.; E. P. Dillon, Pittsburgh, Pa.; J. P. Kearns, Schenectady, N. Y.; A. D. Fishel, Pittsburgh, Pa., and J. Durfee, Rochester, N. Y., also spoke briefly. The exciter arrangements at the Keokuk plant were described and the advantages and drawbacks of the motor-generator were outlined. The opinion was advanced that the design of a practically noiseless machine for substation service is possible if the purchaser is willing to meet the expense.

SWITCHBOARD INSTRUMENTS

In an interesting paper entitled "Switchboard Instruments," by Mr. Paul MacGahan, of the Westinghouse Electric & Manufacturing Company, alternating-current and direct-current indicating switchboard instruments and new forms of alternating-current protective relays were described. It was stated that errors in switchboard instruments may be divided into three classes, namely electrical, mechanical and observational. Because the mechanical defects affect the life of the instruments and increase with time they are, generally speaking, of more importance than the electrical errors in the instrument of to-day. For central-station work high initial accuracy is not deemed necessary. A study of leading American meters shows that for operating purposes they are satisfactory with regard to temperature, self-heating, and phase-angle errors, but that errors resulting from external magnetic fields, residual magnetism and the wave-form of rectified direct current are too large to be neglected.

The mechanical sources of error are excessive weight of moving element, insufficient ruggedness of moving element, insufficient controlling force, and insufficient insulation. A table cited by the author gives the weight and torque of meters of three American instrument makers. A bright future is predicted for the 7.5-in. round-type switchboard meters which the induction principle has made possible, as the scale in this instrument is even larger and more legible than that of the former 9-in. type. It is suggested that in order to obviate the trouble occurring with direct-current instruments due to stray magnetic fields in the vicinity of busbars the instrument of this type should be mounted so that the direction of the busbar field is at right angles to the permanent magnet, as a demagnetizing field passing through permanent magnets at right angles to the direction of the permanent magnetic flux has little or no effect upon the magnet. This method has been found much more successful than that of employing iron shields for instruments, especially where short-circuits produce excessive current in the busbar.

In the new alternating-current protective relays the inverse-time-element characteristics are obtained by the action of a permanent magnet upon a disk. These relays are made in the following types: (1) current or overload, inverse-time-element, operating instantaneously at heavy overloads: (2) current or overload, inverse-time-element, operating non-instantaneously at heavy overloads, the minimum time-element for any overload being adjustable; (3) overload and reverse relays, inverse-time-element, tripping on heavy loads in the normal direction or light loads in the reverse direction, provided the voltage or the power-factor does not fall to a low value; (4) reverse-power, selective-type relays, operating on reverse power but having a selective wattmeter element in the same case so connected as to keep the trip circuit open whenever energy flows in the normal direction.

It is accepted as an axiom that relays located at the substation terminals of transmission lines should be arranged so that tripping can never take place because of energy flowing into the substation. Following this law, the reverse relays described solve the problems of reverse-power protection, even in cases where voltage and power-factor drop to low value during short-circuits. They are particularly useful at the incoming ends of transmission lines.

Discussion

The discussion turned upon the greater reliability of the induction-type, permanent-magnet form of relay as compared with the solenoid-type, bellows-equipped apparatus. Mr. C. P. Osborne, of the Portland (Ore.) Railway & Light Company, emphasized the great need of more reliable relays for the protection of alternating-current circuits. Mr. B. H. Smith, of Pittsburgh, and the author, in closing, defended the reputation of the induction type of relay as capable of meeting a wide range of service demands.

Use of Telephones by Central Stations

Mr. Angus S. Hibbard, of the American Telephone & Telegraph Company, New York, in a paper entitled "Telephonic Communication the Means of Control of Central Stations," shows what wide uses are made of the telephone in the central-station business, especially by the larger companies. With centralized generating stations, it is necessary that one man, the system operator, control the distribution of the energy generated. The extent to which the telephone is employed by the system operator of the New York Edison Company in transmitting orders about the stations and between the stations and substations was described in detail, as were also the systems in use by the Commonwealth Edison Company, the Boston Edison Company, etc. Attention was directed to the diversified uses made of the telephone outside of the purely operating end of the business, such as between branch offices and between the general and branch offices and the public. The New York Edison Company has 24 branch exchanges, 750 telephone extensions, 161 trunk lines, 66 tie lines, 446 miles of telephone circuits, 25 direct exchange lines and a traffic running to about 20,000 calls a day. Traffic reports show that about 17,000 messages are handled daily by the Commonwealth Edison Company.

Discussion

Vice-chairman W. L. Abbott, of Chicago, in discussing the paper emphasized the interdependence of central stations and local telephone companies and advocated the avoidance of apparatus not connected with exchange systems. Mr. A. S. Loizeaux, of Baltimore, emphasized the convenience of multiple conversations in connection with load dispatching.

Design of Distributing Transformers

The importance of a proper selection of insulating materials and of scientific methods of applying them was emphasized in a paper by Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company, on the design of 2200-volt distributing transformers. The insulation problem was stated to be divided naturally into three parts —that is, between the turns and layers of the winding, between the high-tension and the low-tension windings, and between the windings and the metallic parts of the transformer. It was stated that the requirements in the first case are mainly that the material shall be able to withstand the mechanical stresses of bending and the effects of high temperatures, since usually the potential difference between adjacent turns or layers is comparatively small. For effectively insulating the high-tension from the low-tension windings the author mentioned as the latest development a formed sheathing of paper and mica which has very great dielectric strength. This same material was explained to play a very important part in effectively insulating the windings from the metallic parts of the circuit. In closing, the author made a short reference to the allied problem of maintaining an oil circulation and spoke of the reduction of losses through recent improvements in transformer design.

Discussion

Mr. A. D. Fishel, of Pittsburgh, spoke briefly, paying particular attention to the influence of the life of materials on transformer design, the efforts to secure durability being regarded as of extreme importance by the manufacturing companies.

Transformers for Energy Transmission

The essential feature of a paper by Mr. H. H. Rudd, of the Westinghouse Electric & Manufacturing Company, was the strong appeal made for more uniform standards of transformer design. It was urged that in the future, as the small generating plant gives way to the substation of the large central generating plant, the question of transformer design will become of increasing importance. Owing to the diversity of voltage requirements on different classes of load, and also to the great difference in the lengths of distributing lines, transformer design is handicapped by the demand for multiple high-tension and low-tension windings, capable of various series-parallel arrangements, and for a large number of taps. The natural flexibility of the transformer was explained to have adapted it readily to these special design requirements, but at the same time the lack of more standard requirements has increased the cost of manufacture. It was suggested that some middle ground be fixed between the manufacturers' desire for a few rigidly simple and comparatively inflexible designs which can be made and sold cheaply and the users' demand for a large variety of designs so special that their cost would be proportionately very high. Standardization of transformer design at some point between these two extremes would, according to the author, prove of mutual advantage, in that cost would be reduced and performance improved.

Transmission and Distribution

Direct-Current Transmission

In addition to giving outlines of numerous hydroelectric equipments installed recently both in this country and abroad, the report of the committee on progress submitted by Mr. T. C. Martin contained a general survey of the conservation movement and a discussion of certain state ownership plans, including the New York State hydroelectric development bill just vetoed by Governor Sulzer. Special attention was called to the recommendation of official Swedish engineers to use the direct-current rather than the three-phase system for a 200-mile line from Trollhättan Falls, Sweden, to Copenhagen, Denmark.

Discussion

Commenting upon the recent hydroelectric situation in New York State, Mr. Martin affirmed his belief in the wisdom of the public policy committee's work in endeavoring to prevent the passage of injurious hydroelectric legislation committing the State to large developments certain to be ruinous to private initiative and to existing plants. Mr. D. B. Rushmore, Schenectady, N. Y., voiced the need of a better understanding of the purposes of the association on the part of the public.

At the suggestion of Secretary Martin, Dr. C. P. Steinmetz, Schenectady, N. Y., then discussed the economic aspects of direct-current, high-voltage transmission, compared with three-phase, high tension practice. Dr. Steinmetz said that he had had no opportunity to go over the details of the Trollhättan Falls (Sweden) proposed high-voltage direct-current transmission, but that the investigation of many transmission projects elsewhere had never disclosed to him a single instance where direct current was the proper solution of the problem. The choice is largely an economic question. Where it is necessary to cross the ocean bed in a very long and high-pressure transmission it may in some cases be desirable to use direct current. One will get inductive line disturbances from lightning regardless of the character of current used. Direct-current generators are less economical and flexible. He pointed out in conclusion that the use of constant alternating current is a possibility of the future, but that experience favors three-phase, high-tension transmissions.

Mr. E. A. Lof, Schenectady, N. Y., brought out the point that high-voltage, direct-current transmission is less desirable from the operating standpoint. Its selection for the Trollhättan-Copenhagen scheme was largely due to the inability of manufacturers to offer submarine cables one and a half years ago good for over 90,000-volt service.

Messrs. Arthur Wright, London, England, and F. B. H.

Paine, Buffalo, N. Y., closed the discussion, the former bringing out the absurdity of considering machines as small as 1500-kw rating for large transmission work. This is about the limit of successful commutation, and it is a fatal objection to high-tension direct-current transmission.

OVERHEAD-LINE CONSTRUCTION

The committee on overhead-line construction, of which Mr. Farley Osgood, of the Public Service Electric Company, Newark, N. J., was chairman, submitted a report covering its work since the last convention. Final action as to recommendation for changes in the report resulted in a number of changes which simplified the wording of the report in several instances, making it easier of clear interpretation. The committee strongly recommended that the specifications be accepted in the form in which they were presented. On account of the many questions pertaining to construction requirements where conflicting lines do not actually cross but are in close proximity with each other, the committee recommended that the crossing specifications be supplemented with further specifications covering this special case.

With a view to broadening the scope of the overhead-line committee, it was suggested that the title of the committee be changed to the national joint committee on overhead-line construction. It is thought that this will have a tendency to relieve any one society of sponsorship for the committee and will make its organization stronger and its personnel more general. It was stated that owing to the lack of time no definite plan had as yet been evolved, but authority was asked to form such a committee.

Letters appended to the report indicate that the specifications as presented by the committee have the approval of the larger telephone and telegraph companies.

Discussion

Messrs. F. B. H. Paine, Buffalo, N. Y.; D. F. McGee, Portland, Ore.; D. W. Roper, Chicago; T. K. Stevenson, New York; R. D. Coombs, Philadelphia, Pa.; G. A. Sawin, Newark, N. J.; R. J. McClelland, New York, and E. H. Davis, Williamsport, Pa., commented on the report, the consensus of opinion being that the proposed specifications should not be taken as arbitrary. Mr. McGee touched upon the efforts now being made in the State of Washington to standardize and safeguard overhead high-voltage line construction, through co-operation with the engineers of the Public Service Commission. Closing, in the absence of Chairman Farley Osgood, Mr. Paine urged the vital importance of safeguarding telephone lines in territory occupied by dangerous distributing circuits.

TRANSMISSION-LINE CONSTRUCTION

A paper by Mr. R. D. Coombs, of R. D. Coombs & Company, New York, gave an outline of the author's views relating to lines designed for operation at 2300 volts or more and discussed the structural features of tower and pole lines. In regard to clearances it is the author's opinion that at present many of the lines being erected are using poles that are too high. It is far better, he thinks, to trim a few scraggly trees and lower the telephone and low-tension wires than to try to acquire the proper clearance with 60-ft. or 70 ft. poles. Co-operation between existing companies with a view to securing joint ownership of pole line should surely be encouraged.

Although it is admitted that the loading on lines sometimes exceeds that assumed in the specifications of the joint committee, yet these specifications for loading are thought to be sufficiently rigid. Just as bridges and buildings are not designed to withstand tornadoes, so the transmission lines do not need to be absolutely immune from failure. If the factor of safety will eliminate nearly all the failure due to ordinary manipulation and provide for a reasonable variation in the assumed load and for such deterioration as may be assumed in the material, it has served its purpose. Any decrease in such a factor would be dangerous but an increase would be extravagant.

Owing to the varying conditions of different soils the depth to which foundations for towers must be placed cannot be determined accurately and readily by a mathematical formula. As it is impracticable to make advance tests of soil conditions for a long transmission line, it is necessary either to have two standards or to design a single foundation which will provide safety for ordinary variations in the soil. Although foundation cost in wide-base structures is comparatively high, the insurance value of a good foundation makes it well worth its cost. Results obtained from test towers on rigid foundations are sometimes deceptive as a horizontal movement at the ground line may induce stresses not foreseen by the designer. The relative merits of galvanizing and painting can be discussed only as a local issue, since the weather and atmospheric conditions determine largely which should be used. The practice of installing a ground wire or sky wire in a shoddy fashion above high-potential lines is to be severely condemned. The use of a small U-bolt or hook bolt which bites into the ground wire and causes failure should be especially discouraged as the failure of the ground wire is certain to cause failure of the circuit beneath it.

Between the limits of 5000 volts and 20,000 volts it is believed that wooden cross-arms will find favor, but for the higher potentials the metal arms, which are now more common, are probably preferable.

Despite the disadvantage which can undoubtedly be attributed to the wooden pole as a transmission-line support, the day has not yet come when it may be discarded as uneconomical. In the transition which transmission structures are undergoing from wood to metal the excellent record of wooden poles in line work should not be overlooked in the analysis as their lesson is well worth attention. The more permanent types of support may be divided into the rigid under-base steel tower, the semi-flexible pole made either of steel or of reinforced concrete, and the flexible steel pole or frame. The selection of any of these types of poles over the others, apart from their relative cost for any given line, should be made upon the basis of adaptability. It is the author's opinion that the wide-base tower and the semi-flexible pole when properly designed provide the maximum security against service interruption. The greater strength possible in such structures allows the use of larger spans with a subsequent reduction in the number of insulators and hence in the number of insulator failures.

In conclusion, the author appended informally his views on desirable detail requirements, in order to promote discussion upon proper line construction for potentials in excess of 6600 volts.

Discussion

The paper was discussed by Messrs. E. A. Lof, Schenectady, N. Y.; F. B. H. Paine, Buffalo, N. Y.; R. D. Coombs, New York City; A. N. Richardson, Kansas City, Mo., and C. P. Osborne, Portland, Ore. The desirability of increasing the length of the middle arm in suspension insulator lines as a protection against sagging in sleet storms was brought out. In one case trouble from wind lifting the suspension insulators carrying aluminum wire was eliminated by attaching weights under the insulators. The use of a grounded metal strip on the tops of wooden cross-arms was also criticised. Mr. Osborne cited suspension insulator punctures on some lines in Oregon, the cause for which had not been definitely determined. A possible source of difficulty is a high-powered radio station in a hollow within working radius of the line.

HIGH-TENSION UNDERGROUND CABLES

The committee on underground construction, of which Mr. W. L. Abbott, of the Commonwealth Edison Company,

Chicago, was chairman, confined its annual report to the subject of high-tension transmission cables. Practice regarding the periodical high-potential testing of such cables was shown to vary considerably. Several companies were said to be installing apparatus with a view to making such periodical high-potential breakdown tests on all of their transmission lines, while other companies already having the necessary equipment have abandoned the practice of making these tests periodically. It was thought by the committee that in general these tests increase the liability to subsequent break-downs and often do not disclose existing points of weakness. The majority of the companies report that such tests are not applied.

In this report more space was given to the discussion of carrying capacity of cables than to any other subject. It was shown that hardly any exact information is possessed by central-station operators as to the safe limits of loading under various operating conditions. The carrying capacity of a cable was stated to be limited by the temperature of the insulation, and the life of the cable to vary in inverse ratio with this temperature. Hence the three factors to be considered in determining the safe current load of a cable are temperature of inclosed conductor, temperature of surrounding air and objects, and heat generated in the insulation itself due to current leakage through the dielectric. The committee recommended that a very decided increase be made in the rating during the winter and also that the current rating be varied inversely with the voltage on account of the heating of the insulation due to leakage of current.

From the well-known fact that the potential gradient of insulated wires is much higher in that portion of the insulation near the conductor than in the outer layers and the equally well known law that the fall of potential across a series of insulators of varying specific inductive capacities is inversely proportional to their capacities, the committee stated that use might be made of a graded paper insulation formed by saturating successive sections with oils so chosen as to give specific inductive capacities varying in the proper proportions. Such a step, it was explained, would allow of a smaller diameter of cable with the same factor of safety, or of a higher voltage, the diameter and factor of safety remaining the same.

With the increasing size of rotary converters and with the resulting increase in the size of the conductor, in order that a line may have sufficient capacity for one converting unit, some companies have reached the maximum size of three-conductor cables (with round conductors) that can be installed in a duct nominally 3 in. in diameter. The paper stated that, in order to meet this condition and to secure a cable with larger copper cross-section or thicker insulation, or both, cables have been developed with conductors of clover-leaf or sector form. As to the installation of current-limiting reactors, the committee found that these are necessary on generators where the load on one bus exceeds 50,000 kw. One company has found it expedient to divide the bus into several sections and interpose between them current-limiting reactors, and one company has installed such reactors on each of its high-tension feeders. All of the above-mentioned companies are operating an ungrounded system, and none of the companies operating with a grounded neutral has found it necessary to install these reactors.

Some attention was given in the paper to the discussion of methods for protection of cables in manholes. The advisability of running parallel routes was also treated, the advantage being an increase in reliability of service, since in case of accident to one circuit the other would be able to handle the traffic temporarily until repairs could be made. Among other things, the report touched upon the subject of trouble reporting and showed a uniform report sheet recommended for this purpose. Practical hints were given on the installation of cables in ducts. In closing, the author suggested standard form specifications for paper-insulated high-tension cable and for rubber-insulated, lead-covered cable for pressures in excess of 2000 volts.

Discussion

Mr. C. W. Davis, of the Standard Underground Cable Company, Pittsburgh, Pa., praised the report, but pointed out a few particulars in which the practice of his company differed from that of the committee. One of these relates to the safe loading of cables. Mr. Abbott told of a remarkable accident by which a man was killed from electric shock when holding the end of a 40-ft. dry manila rope which was in contact at the other end with a high-voltage circuit. The fatality was inexplicable until the rope was cut, when it was found that the manufacturer had stranded into it very fine steel wire.

Lightning Arresters

Although normally a survey of the conditions of protection, the paper by Prof. E. E. F. Creighton, of the General Electric Company, was largely devoted to the subject of lightning arresters, their operation, application and latest developments. The multi-gap arrester was said still to hold a predominant position in distribution work at or about 2300 volts, because of its lesser cost and of the fact that it can be made insensitive to arcing grounds and at the same time sufficiently sensitive to protect transformers. No material technical improvements have been made in the multi-gap arrester during the past few years. It has been learned that in order to get a high degree of protection for lighting transformers an arrester should be placed at each one, since if it is located only a few poles distant it will be ineffective against the concentrated and localized potentials due to lightning. In order to supply this increased demand and at the same time reduce the cost of the arrester, there has been developed a self-housed, self-contained form of the multi-gap known as the compression-chamber lightning arrester. In this type the shunt resistor has been discarded and more series gaps have been added, thus giving it better arc-extinguishing qualities.

Turning to the subject of aluminum arresters, the author said that a careful study of the conditions has revealed the fact that the charging resistor represents a good investment. The qualities which make the aluminum arrester a good discharger for lightning make it take a heavy current if the films are not in good condition. It is possible to place in series with such an arrester a resistor of considerable resistance without preventing it from taking its full charging potential, and this solves the problem of limiting the charging current to a reasonably small value, even though the films are badly dissolved. Another measure found advisable, in order to prevent arcing across the horn-gaps while charging, is the use of spring clips. Previous to January, 1912, an organic electrolyte was used in which a fungus growth was apt to appear accompanied by the formation of vinegar which had a deleterious effect on the film. Since that date the operation of this type of arrester has been greatly improved by the use of an inorganic electrolyte. Oscillograms of current and voltage conditions during arrester discharges were shown and discussed.

Speaking of the grounding of apparatus, Professor Creighton stated that ordinary pipes driven into earth well salted will give as good a ground connection as can be obtained. Most of the resistance of an earth connection lies in the immediate neighborhood of the pipe. Moisture is necessary to reduce the resistance, and the salt supplies this conducting moisture. In conclusion mention was made of the opportunity for developing a good system of overhead grounding.

Discussion

Mr. H. W. Hough, of Cleveland, favored water-pipe grounds, pointing out that earth-pipe grounds, even when salted, vary greatly in resistance. Mr. D. W. Roper, of

Chicago, instanced a lightning stroke on a suburban line at a point 1000 ft. away from an aluminum-cell arrester which jumped across a 3-ft. wire spacing without showing a trace of its presence in the arrester record, although the gap was but ¼ in. The importance of placing arresters as close as possible to the danger point was emphasized. Mr. E. A. Lof and Professor Creighton also spoke briefly, the latter voicing the value of the Alexanderson 200,000-cycle alternator in testing insulators on high frequencies. By this means resonant points in transformer windings can be artificially determined.

Suspension Insulator Design

Instead of the large factor of safety which would naturally be expected in an insulator, Mr. A. O. Austin, of the Ohio Brass Company, New York, stated in a paper on suspension insulators that it is abnormally small. Even a very slight increase in this safety factor means, he said, an appreciable gain in reliability and, because of the enormous investment that depends upon the operation of the transmission line, it is worth while spending a considerable amount of money to obtain an increase in reliability. The ordinary insulator under load was compared by the author to a steel spring, working near its elastic limit on a fluctuating load. The author showed that there is a very close relation between the electrical and the mechanical stresses in an insulator of this type and gave a mathematical treatment of the design problem.

The factors spoken of as exercising an influence in the puncturing of insulators were the suddenness, frequency and amplitude of the surge or disturbance, the physical proportions of the insulator and the dielectric strength of its material, and finally the mechanical strain on the insulator. Some attention was given to the proper design methods to care for these factors. Testing was advocated as an effective way to eliminate weak insulators, and it was suggested that the tests be carried to the point where "spilling over" occurs. A diagram was shown of a suggested apparatus for subjecting the insulators to very sudden stresses. The effect of time lag on puncture was shown, and a report was given of an investigation made of the distribution of the stress in a series of insulators of the suspension type. Some attention was also paid to the subject of protective air-gaps.

Discussion

Prof. E. E. F. Creighton expressed his satisfaction at the author's variable-frequency tests and briefly outlined the creepage effects in a three-petticoat insulator accompanying frequency increases. Mr. L. C. Nicholson, of Buffalo, said that a greater factor of safety is obtained by placing the insulator disks as closely together as possible. The problem is largely a function of the ratio of dielectric puncture to dry flash-over between terminals. Tests conducted by the speaker indicate that increased mechanical strains tend to hasten electrical failures, although in practically no case has a disk failed immediately after passing the flash-over voltage. The action appears to be molecular in character. The same percentage of failure was obtained after as during the imposition of a mechanical strain. In closing the discussion the author said that the effect of combined electrical and mechanical stresses is serious with slight flows under mechanical loads.

Grounding of Secondaries

The report of Mr. W. H. Blood, Jr., of the Stone & Webster Engineering Corporation, Boston, as chairman of the committee on grounding secondaries, was a short review of the committee's work since its appointment six years ago. The committee has succeeded in having the National Electric Code revised, and a rule bearing upon this subject now requires the grounding of secondary circuits up to 150 volts and leaves the grounding optional above that voltage. The committee recommended as the best ground a solid connection to underground metallic piping systems, making these connections at each service entrance or at other places where the piping can be reached and the connections periodically inspected. The committee believed that it had fulfilled its mission and asked to be discharged.

Discussion

The report was presented by Mr. W. H. Blood, Jr., chairman. There was no discussion, but at the suggestion of the committee the session voted unanimously in favor of its being discharged from further duties.

Poles and Pole Preservation

A paper by Mr. Russel A. Griffin, of the Western Electric Company, Chicago, on poles and pole preservation gave some statistics on wooden poles used by the telegraph, telephone, railroad and electric-lighting industries. The author discussed the subject of wood decay, concluding with brief descriptions of the various methods now in vogue for preserving timber in order to insure maximum life at minimum investment. According to Mr. Griffin, the demand for wooden poles is now approximately 4,000,000 a year, which at an average cost of $3 each represents an annual investment of $12,000,000. Of these about 700,000 are used in the electric-lighting industry. It requires about sixty years for a tree to attain a growth suitable for poles, and production is about one-fifth the rate of consumption. Untreated chestnut and cedar poles have a life ranging from twelve to fifteen years. The latter are used most extensively, supplying about sixty per cent of the demand, while 20 per cent of the poles in use are chestnut. In the opinion of the author coal-tar creosote is the best timber preservative. The various systems of preservation, such as charring, concrete or loose-stone setting, tar or asphalt coating, painting and creosoting by the closed-tank pressure method, open-tank method and by brush treatment, were described briefly.

Discussion

In reply to several questions the author said that the imported carbolineums are giving excellent service, particularly in cold applications. Any of the coal-tar creosotes passing the association's specifications, whether of domestic or foreign make, can be used successfully. With the brush treatment it is necessary merely to treat 2 ft. above and 2 ft. below the ground line. On any 30-ft. pole two coats of oil, requiring about 0.5 gal., or 4 lb., of oil are sufficient for this treatment. The inner bark should always be taken off in applying a preservative process.

Distribution Problems

Unusually broad significance was attached to the term "distributing lines" in the report of the committee on distributing lines, of which Mr. P. M. Downing, of the Pacific Gas & Electric Company, San Francisco, was chairman. In this report they were defined as all lines from which a general distribution service is given, regardless of voltage. The author dealt particularly with Western and Pacific Coast conditions, since the largest advances in some ways have been made there, and showed that during recent years there has been a big change in the methods of transmitting and distributing electrical energy. Principal among the changes noted was that in voltages, the statement being made that transmission voltages had been increased by from 200 to 300 per cent or more and distribution voltages raised to a third or a half of the values formerly used for transmission. The question of transformer, meter and insulator equipment for these high-tension distributing lines was gone into briefly. Recent developments in alternating-current apparatus and in turbo-generator units were thought by the committee to have made alternating-current service about as satisfactory for drive and as reliable as direct-current service. Star connection of transformers was favored up to 15,000 volts and the information was

given that many companies prefer the delta connection. The type of line construction was thought to have stayed fairly constant during recent years, although improvements in insulators have been rapid. Pin-type insulators were considered better for low voltages, and suspension type for voltages of 60,000 or over and for special climatic conditions. It was stated that there are portions of the Pacific Coast where salt fogs and dust storms combine to form conducting films on the surfaces of insulators. For such cases the suspension type of insulator was recommended; these must be wiped clean at certain intervals. Economic considerations in the extension of lines and fixing of development rates were mentioned in closing.

Discussion

Mr. F. G. Hamilton, Visalia, Cal., said that in the San Joaquin Valley the distributing pole line has a spacing of from 300 ft. to 400 ft. Poles 30 ft. long are used on the shorter spans and 35-ft. and 40-ft. poles are employed on the larger ones. At highway crossings the poles are 5 ft. higher than elsewhere. In closing the discussion, Mr. L. A. McArthur, of the Pacific Power & Light Company, Portland, Ore., pointed out that 30-ft. poles are too short for Oregon and Washington conditions, where the alfalfa stackers are liable to hit the lines if the farmers are careless.

Circuit-Breakers and Lightning Arresters

A paper by Mr. J. N. Mahoney, of the Westinghouse Electric & Manufacturing Company, summarized the standards of design and operating practice at the present time in the matter of circuit-breaker and lightning-arrester equipment. He said that because of the modern tendency toward very high voltages, large outputs and long lines, arising from recent consolidations of numerous distributing systems, the manufacturers have been forced to do a great deal of research and development work in developing protective apparatus.

Three factors were presented as of controlling importance in the construction of oil circuit-breakers: (1) They must be insulated for the voltage at which they are rated; (2) they must have sufficient carrying capacity for their rated current, and (3) they must have sufficient circuit-breaking capacity to meet the conditions at the point where they are applied and to suit the character of the service. Extensive treatment of the last requirement was given embracing the various classes of oil circuit-breakers. The same points were also considered in regard to carbon-break circuit-breakers.

Details of the electrolytic type of lightning arresters were given at length, and the author favored the use of this class of arrester wherever the value of the apparatus to be protected would warrant it. Recent investigation of the effects of daily charging were explained to have resulted in producing a great improvement in operating characteristics. These arresters are at present available for use with voltages up to 165,000, the highest thus far adopted commercially.

Discussion

In answer to questions, Mr. Mahoney said that additional protection against lightning is being secured in oil switches by placing porcelain barriers between the terminals and by installing porcelain tubes over the terminals. The reactance type of breaker, in which a fairly heavy inductance is cut into the circuit for a few cycles prior to the final circuit opening, renders possible an equalization of conditions in the adjacent line with little danger of surges.

Receiving Apparatus

Mr. M. R. Bump, New York, chairman of the committee on receiving apparatus, presented a report which criticised the lack of interest among member companies in supplying information to the committee. He pointed out that here is an important field for research work, and said that until the association is prepared to spend something on investigation in this direction the committee cannot show the results which it would like to bring out for the benefit of the industry.

Lamps and Illumination

Flame-Arc-Lamp Developments

As a result of the growth and development of our cities and of a broader general understanding of the principles of prosperity, the increasing demand for more and better light has become an important factor in our community life. The lighting industry has kept pace with this demand, and the result is shown in the perfecting of the long-burning flame-arc lamp. Dealing in his paper with the subject of this lamp and the development in its design, Mr. W. A. Darrah, of the Westinghouse Electric & Manufacturing Company, outlined the four essential requirements in its construction. These were given in order of their importance as reliability, minimum demand for attention, economical performance and satisfactory illumination. To meet the first two conditions, the lamp must be absolutely weatherproof, all parts must be of material not subject to rapid deterioration under service conditions, and friction must be kept to a minimum, initially and after severe service. Design problems in connection with these lamps were explained to fall under two classifications, statics and dynamics. Under the head of statics, the author treated the selection of materials and proper design of the lamp case for greatest strength and accessibility, and in this connection it was explained that no small part of the problem is the production of a pleasing appearance. The methods for eliminating both initial and progressive friction were explained under the head of dynamics. Regulation of the feed so as to produce a smooth steady light was the last point touched upon, and curves were introduced to show the various controlling factors in this problem.

Discussion

Mr. A. S. Loizeaux, of Baltimore, Md., commented on the troubles experienced in using flame arcs on 25-cycle circuits. With present types of lamps such operation, he said, is quite unsatisfactory. If smooth lighting at 25 cycles can be obtained, it will be a great help to the arc-lighting industry. Mr. Darrah said that the flame arc is materially better than the inclosed arc on low-frequency circuits in the matter of flicker. At 25 cycles the flicker is, however, appreciable.

Incandescent-Lamp Developments

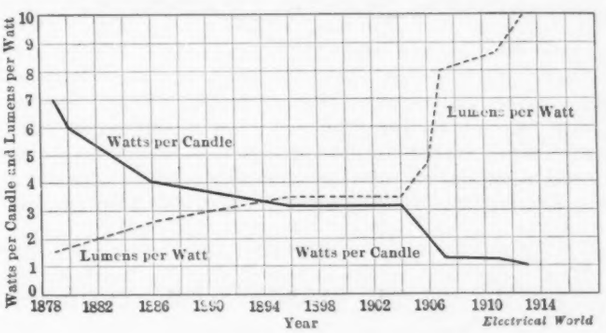
Instead of holding its findings and important data for presentation at the annual convention, the lamp committee, of which Mr. F. W. Smith, of the United Electric Light & Power Company, New York, was chairman, announced in its report that it had felt that the interests of the members would be served better by the disseminating of information as soon as collected and arranged, and hence it had published in the *Bulletin*, at various times between September, 1912, and April, 1913, four articles on the following subjects: "The Passing of the High-Wattage Carbon Lamps," "The Increasing Importance of Sign Lighting," "The Tungsten Lamp in Residence Lighting," and "Incandescent Lamp Developments Since the Last Lamp Committee Report." These articles were reproduced in the report as an appendix, and there was given in the paper proper additional information of importance. It was shown that during 1912 the sales of tungsten and metallized-filament lamps increased 14.6 per cent of total sales, while during the same period carbon-lamp sales decreased 27.4 per cent of total

sales. Another point investigated by the committee was the policy of central stations with regard to the supply and renewal of incandescent lamps. There seemed to be no fixed or general practice in the matter. Some companies give the first installation free and renewals at cost, some furnish free renewals on commercial service but not on domestic service, still others charge for the first installation and give renewals free, while some do not supply lamps at all.

The past year was said to have witnessed a more rapid development in the tungsten-filament lamp than previous years. Improvements and economies in manufacturing processes made during the year have enabled the manufacturers to put into effect reduced schedules of prices on tungsten lamps. Developments have also improved the quality of the lamp, and a constant increase in efficiency has been possible, while the life of the lamp has been maintained at a point most suitable for commercial service and the life is now guaranteed. The sign business was indicated as a very promising field for future development, and the committee stated also that the central stations might do more toward raising the standard of residence lighting, with profit to themselves and with no inconsiderable benefit to the public.

PROGRESS IN LAMP MANUFACTURE

Messrs. J. E. Randall and Evan J. Edwards, of the National Electric Lamp Association, Cleveland, presented a paper on "Recent Progress in the Art of Lamp Making." No spectacular changes in the manufacture of the regular incandescent lamps have taken place during the year, according to the authors of this paper. The rated specific consumption is, however, still being improved. The accompanying diagram is of a great deal of interest in showing the improvements graphically from the earliest days of incandescent lamp making. The improvements of the past year are credited to the use of chemicals which retard the blackening of the bulb. This plan has made it practicable to employ smaller bulbs for a given wattage, notably in the case of 40-watt and 60-watt lamps.



INCREASING EFFICIENCY OF LAMPS

The most striking new development is considered to be in the use of filament wound into a helical coil, which coil may be mounted on supports in various ways or even itself wound into a coil to obtain greater concentration. The coil construction allows a great length of filament to be put into a small space without appreciable leakage between adjacent turns. This makes it possible to construct lamps to focus closely, as is required for small stereopticons, sidewalk projectors, street-railway and electric-vehicle head-lamps, and the like.

The coiled filament may be mounted on small supports of the regular spider type and placed in miniature bulbs of the various candelabra and decorative types. It may be placed in a tubular bulb to make a showcase lamp, which consists of a single straight section of coiled filament carried through the middle of the bulb, the return circuit being made through the heavy wire support.

Discussion

Mr. John W. Howell, Harrison, N. J., said that 60-watt and 100-watt tungsten lamps now give double the life for the same efficiency as the products of a year ago, through the use of chemicals known as "vacuum getters." Even at present the lamp manufacturer does not know how to apply the chemical method to lamps with very thin filaments, although progress is being made. The 10-watt lamp is five times as good as a year ago owing chiefly to learning how to prevent overlapping of the filament. The tendency of prices is downward as lamp quality goes up. Lamps are now made with great accuracy as regards voltage or current rating, and the time is approaching when great savings will be made in apparatus cost through the feasibility of establishing a uniform distribution voltage. Series lamps for street lighting are now being standardized at 6.6 amp rather than manufactured with a range from 6.4 amp to 6.8 amp. More than fifty research experts are working with more than sixty trained assistants in four General Electric laboratories to make lamps better and cheaper.

Mr. Norman Macbeth, New York, stated that the total light output, and not the horizontal candle-power, should be the criterion by which lamps are rated.

Mr. F. W. Willcox, New York, who has lately returned from a two years' sojourn in England, reviewed the development of tungsten-lamp applications in Great Britain and expressed the wish that American methods of aggressive co-operation might be utilized in the British Isles. The conditions there are different from those prevailing in this country on account of the fact that over 65 per cent of the installations are of 250 volts. There is no question that the tungsten lamp has stimulated the growth of the electrical industry abroad.

STREET-LIGHTING CONTRACTS

The committee on street lighting, of which Mr. J. W. Lieb, Jr., of the New York Edison Company, was chairman, reviewed the developments in street-lighting specifications during recent years and incorporated an excellent historical sketch on the subject in its report. It then discussed briefly the various methods for measuring the illuminating power of street lamps which have been proposed from time to time and made recommendations regarding a contractual basis for street lighting. The measures of street lamps and street lighting include both those which have been adopted in certain instances and others which have been proposed. Those based upon tests of lamps include unidirectional light intensity, rating by light intensity in a particular plane, rating by mean intensity throughout a particular zone, watts and miscellaneous, while those based on tests of illumination cover the normal illumination at heights varying from 3 ft. to 6 ft. above the street level, vertical illumination, illumination on a surface inclined at an angle of 45 deg. and horizontal illumination. Among the principal features are an official pronouncement in Germany and tentative recommendations now under discusison in England. Neither of the latter, however, represents the unanimous conclusions in either country. The committee directed attention to the proposition that the best means of studying street illumination and arriving at the relative illuminating value of two different installations is not necessarily the best method of specifying the street-lighting service which the street-lighting contractor undertakes to give and the municipality agrees to purchase. It did not recommend street-lighting specifications covering the subject of street illumination, etc., because it did not make the needed investigations upon which to base them; but, assuming that a decision had been reached as to the type of illuminant to be used, the committee recommended the following procedure in drafting the street-lighting contracts:

(1) Describe the lamp which is proposed, including in the description electrical values (volts, amperes and watts) and total light flux (lumens) or mean spherical candle-

power, employing well-authenticated conservative values representative of the performance of the lamps under the conditions of service contemplated. (2) Describe the equipment to be supplied with the lamps, including type of globe, reflector, if any, etc. (3) Specify reasonable average limits to be allowed above and below the representative values of light flux given in the description to allow for inherent variables and test inaccuracies which are beyond the control of the contracting company. (4) Provide for basis of substitution of other types of illuminants for those specified, either lamps of equivalent illuminating value having other characteristics or lamps of different illuminating values, in order to provide for progress in the art during the term of the contract. (5) Prescribe the method of test of the circuit while in actual operation to determine the conditions of energy supply as found under actual operating conditions on the system. (6) Prescribe procedure for proving fulfilment of contract in respect to illuminating qualities of lamps, including therein the selection for testing in a properly equipped testing laboratory and under the operating conditions as found of a reasonable number of lamps taken from the system and a test procedure which will assure expert methods, approved apparatus and fair evaluation of the lamps.

Discussion

Mr. J. R. Cravath, of Chicago, Ill., spoke of the silhouette effect in street lighting. Something simpler than the 1907 and 1908 N. E. L. A. specifications for street lighting is needed, he added. The present recommendations of the committee would make the interpretation of contracts much easier.

Dr. Gardner, manager of Association Island in Lake Ontario, explained the advantages of that locality as a meeting place for electrical bodies. The island is to be thrown open as a rendezvous for all accredited electrical men, so that committees of 30 to 150 can be accommodated from July 5 to Sept. 1.

Interior Voltage Drop and Central-Station Revenue

In a paper on "The Relation of the Incandescent Lamp to Lighting Service," by Messrs. M. D. Cooper and Robert C. Campbell, of the National Electric Lamp Association, Cleveland, attention was called to the importance of proper voltage selection of incandescent lamps and accessory energy-consuming devices as most essential in order to obtain economical and satisfactory service. The authors made a careful investigation of the amount of voltage drop between the service switch and the customers' sockets in industrial, commercial and residential service. The results obtained, as shown in the accompanying table, which is a summary of all the data collected, seem to indicate that a conservative estimate would place the average amount of interior voltage drop at 2 volts.

SUMMARY SHOWING APPARENT GAIN IN PERCENTAGE BY ELIMINATING EFFECT OF VOLTAGE DROP

Service	Average Load, Kw.	BOLTS DROPPED		GAIN IN PERCENTGE	
		Maximum	Average	To Customer in Candle-power	To Central Station in Revenue
Industrial.....	5.10	5.02	2.94	10.4	4.4
Commercial.....	10.90	3.94	3.03	10.8	4.6
Residential.....	0.55	2.08	1.57	5.4	2.3
Grand average	.....	3.68	2.50	8.9	3.8

Accordingly, the central stations are losing about 4 per cent of their lighting revenue and the customers about 9 per cent in candle-power. Aside from loss the customers experience a variation in brightness in light.

No general recommendations were made as to methods for eliminating the losses of candle-power and revenue, attention merely being called to the great benefits that would accrue from taking this drop into consideration.

Discussion

Mr. Preston S. Millar, New York, expressed appreciation of the authors' work, and Mr. K. H. Hansen, St. Louis, Mo., voiced the need of closer co-operation with architects in laying out wiring installations in residences so as to provide ample capacity for the use of appliances. Replying to an inquiry, Mr. Cooper said that the load conditions in general are approximated in the paper for all-day service and not for the peak load.

Wire for Overhead Distribution Circuits

Referring to the several kinds of wire commercially available for overhead distribution circuits, Mr. T. K. Stevenson, of the Duplex Metals Company, stated that copper-clad steel wire excels for certain classes of service. This wire is made by dipping a steel billet into a bath of supermolten copper which is so hot that it heats up the billet to a point where it actually absorbs a certain amount of copper. When the surface of the steel begins to melt, the billet is withdrawn and this surface is wet down with a copper-iron alloy. The alloy-coated billet is then placed in a mold and a coating of copper cast around it, the copper welding to the coper-iron alloy. By this process there is no surface contact between the pure copper and pure steel, the former grading into the latter through a series of copper-steel alloys. Three varieties of this reinforced wire are made, having conductivities of 30, 40 and 47 per cent that of pure copper.

Wire of this kind finds its field of usefulness in those cases where fair electrical conductivity has to be combined with great mechanical strength and resistance to corrosion. Weatherproof aluminum wire is more expensive than weatherproof copper wire per unit of conductivity, has low tensile strength and requires special care in handling. Weatherproof iron wire is open to the same criticism as to conductivity and is if anything a little weaker than hard-drawn copper wire. From the standpoint of conductivity copper is the ideal conductor but it lacks the mechanical strength for some classes of service. Estimates of comparative costs of copper and of copper-clad steel wire installations given by Mr. Stevenson favored the latter product.

Discussion

Mr. Stevenson's paper was discussed briefly by Mr. O. C. Mason, of Baltimore, Md.

Soliciting and Utilization

Selling Electrical Appliances

To present a policy and some methods that might be advantageously utilized by central stations in the sale of electrical appliances was explained to be the object of the report of the merchandising committee, under the chairmanship of Mr. T. I. Jones, of the Edison Electric Illuminating Company of Brooklyn. It was noted that in the introductory stage of this development goods were frequently sold at cost or less, but now that this stage has passed the committee thought that better co-operation between the central stations, manufacturers, contractors and supply houses can be obtained by placing this part of the central station's business on a strictly merchandising basis. The proposed methods were discussed under three headings: buying, selling and accounting. It was stated that the initiative for purchase of appliances should come from the sales department, requisitions being issued through the pur-

chasing department. The question of whether or not more than one manufacturer's goods should be handled was said to depend largely on local conditions. From the sales standpoint, the advantages of an adequately equipped exhibition room in a central location were emphasized. One of the tricks of the trade was said to be the placing of the application desk and cashier's booth at the rear of the appliance salesroom so that customers in calling to arrange for lighting service or to pay their bills would be forced to notice the exhibit, if only casually.

From the replies to a large number of inquiries, the committee decided that the average cost of carrying on a retail appliance business is about 22 per cent of the gross sales receipts, and the paper advised that, in order to care for this expense and to provide for a fair net profit, an average gross profit of 33⅓ per cent should be realized on retail sales. The sale of appliances on the instalment plan was said to be a growing practice among central stations, but their methods in the matter were found to vary greatly, some charging the same prices as for cash sales, others making the cash sale standard and charging an extra percentage on sales by the instalment plan, while still others make the latter plan the standard method but offer a discount for cash. The issuing of appliances on trial was found to have been tried by a number of companies, but the committee after investigation recommended that this practice be limited to electric irons. Suggestions were offered for increasing the sales by proper co-operation between the central station and the contractors, and some attention was given to the subject of advertising. In closing, recommendations were made for a simple accounting system to cover this branch of central-station business.

Discussion

Referring to a recent toaster campaign mentioned by Mr. Jones, during which a certain toaster was sold for one day at half its regular retail price, Mr. L. H. Scherck, Poughkeepsie, N. Y., declared that such practice was not only a bad scheme for the central-station but involved poor business principles. While perhaps a good thing for the manufacturer, this price-cutting would surely injure, he insisted, the interests of the central station. He then described his own experience in selling some vacuum cleaners originally priced at $90. In order to aid sales, these devices were offered for several months at $60, but only a few were sold. Later the price was restored to $90 and fifty were disposed of in less time than had been required to get rid of the preceding small lot.

Mr. M. S. Seelman, Brooklyn, N. Y., explained that in the Brooklyn one-day toaster campaign referred to by Mr. Scherck all of the local contractors were offered the same terms and proposition as accepted by the central station.

Mr. M. O. Dell Plain, Syracuse, N. Y., advocated the policy of central-station companies' handling appliances, for the public, he said, looks to the company to popularize these devices and to give advice concerning their use. Prices should be maintained, he insisted, in order to protect the contractors and dealers, for the latter usually lack the organization and selling staff of the utility corporation. In closing, Mr. Dell Plain made a strong plea that the association and its Commercial Section accord greater representation and attention to the small central stations who are in the greatest need of the help it has to offer.

As evidence that price alone does not determine sales, Mr. A. C. McMicken, Portland, Ore., told of various selling schemes to which he had resorted in trying to dispose of an overstock of a certain make of electric iron. To accelerate sales, the price of these irons was set 50 cents below that of two other standard makes. But to his surprise most of the people preferred to buy the more expensive irons because they assumed they must be better. As a check, Mr. McMicken then interchanged prices, and at its new 50-cent-higher price the over-stock of special irons disappeared rapidly, while the standard lot which was formerly so popular moved only slowly at the lower price.

As a practical matter of committee work, said Mr. E. W. Lloyd, Chicago, it is often difficult and expensive for men of the smaller companies to attend committee meetings, and for this reason the committees have usually been made up of the large-company representatives, although without intention to slight the interests of the numerous small properties.

Mr. M. C. Osborn, Spokane, Wash., spoke of the importance of keeping the appliance "busy" after it has been sold. His own company made 8000 iron repairs during last year at an average cost of 6 cents per job. As the cords of electric irons are their most vulnerable part, he recommends that his customers buy two cords, thus always having a reserve on hand in case of the breakdown of the first.

Mr. Douglass Burnett, Baltimore, Md., suggested appointment of a Commercial Section committee on "the needs of salesmen." In arranging campaigns, he said, local conditions must be studied. He recommended more electrical storerooms in which to sell goods rather than to display them. Many companies make the mistake of weaving too much red tape about the present or future customer. The advantages to be gained by numerous detailed inquiries on blank application forms, etc., are usually so slight that it hardly pays to "muddy up," as he expressed it, the cordial relations which should prevail between customer and corporation. Let the central-station man, he said, take the customer's viewpoint in analyzing his own methods, and "attend to business in a business way, forgetting that he is a central-station man!".

Mr. T. I. Jones, chairman, said that the majority of the committee on electrical merchandising feels that the central station should engage in the sale of appliances to customers at a profit. It is a fallacious view, he added, that such sales should be confined to contractors and dealers; and he expressed approval of the plan of cutting prices to introduce devices to the market.

Rate Research

An elaborate and highly instructive report was submitted by the rate research committee, of which Mr. E. W. Lloyd, of the Commonwealth Edison Company, Chicago, was chairman. Of the 108 pages composing the report 93 pages were devoted to existing rate schedules of some of the larger member companies. No two of these schedules were alike, yet the committee was enabled to show that, although differing widely, yet the schedules can be presented in an absolutely uniform manner and so clearly and concisely that there can be no misunderstanding as to the actual rate.

The Electrical Salesman's Handbook

A very brief report from the committee on the "Electrical Salesman's Handbook," Mr. E. L. Callahan, of H. M. Byllesby & Company, chairman, outlined what had been accomplished during the past year in collecting and arranging this book. The object of the work was explained to be the accumulation in a systematic way, and the placing in the hands of commercial men, of complete and dependable information which will assist them effectively in closing valuable business. The data given were taken from the practical operation of plants under prevailing conditions and in no case under test conditions. Suggestions for the handling of the work for the coming year were offered, and a request was made for information along various lines not yet covered.

Discussion

With a complimentary tribute to the large amount of useful work accomplished by the committee as evidenced by its report, Mr. F. H. Gale, Schenectady, N. Y., moved that the thanks of the association be tendered it. The motion was carried unanimously.

Mr. Norman Macbeth, New York, urged that more attention be devoted to data on lighting installations. It is the general conception among central-station men, he declared, that their lighting business, the very staff of the industry, needs only to be waited for, and that its fullest development will come without especial effort. Mr. Macbeth proposed that separate sheets be used for illumination data.

In answer to a suggestion from Mr. M. C. Osborn, Spokane, Wash., that as an aid in figuring prospective customers' rates the figures for maximum demands of installations be inserted in the data sheets, in addition to the connected loads now given, Mr. E. W. Lloyd pointed out that most operating companies are not equipped with suitable instruments for determining such loads.

The Field for Small Central-Station Development

To-day there are in successful and fairly profitable operation in the United States about 8000 plants with a combined equipment rating equivalent to over 100,000,000 16-cp lamps. The earlier plants were forced to locate in centers of considerable size in order to get sufficient custom to make them pay, and the developments and extensions of central-station service in the larger towns and cities have been so rapid that they have had a tendency to hold men who under other circumstances might have become promoters of central stations in the smaller communities. In a paper by Mr. J. E. Kearns, of the General Electric Company, attention was called to the development of the small station by serving a group of villages in more or less close proximity. He said that the time has come for such extension of central-station service, and he dealt at some length with the problems involved.

Of primary importance, it was explained, is the development of a high diversity-factor, its threefold advantage being that it allows of meeting the requirements of a large number of consumers with a moderate investment in equipment, that it results in lower cost of production because, by proper distribution of demands, the generating units can be operated at nearer to their most efficient loading more of the time, with the corresponding saving in labor and fuel costs per unit of energy generated, and finally, that it improves the load-factor of the station. In locating small central stations the most important items to be considered are the method of driving the generators, the proximity of fuel supply, pure water supply, railroad facilities and the possibility of later expansion of the plant; also the topography of the country as affecting the distributing system.

A valuable feature of Mr. Kearns' paper was a portion devoted to an analysis of the equipping and operating expenses and of the revenues of a small central-station system delivering energy for lighting and motor service to a group of small villages in the northwestern portion of New York State. Details were given in itemized form of the various pieces of apparatus for the main station and for the substations, located one in each village. Useful information was given on those parts of the generating, control, distributing and consuming equipment which are most apt to prove troublesome.

Mr. Kearns advocated improving "seasonal diversity-factor" by equipping the central station with ice-making machinery for use in the summer months and by using exhaust steam in the winter months for steam-heating service. A brief mention was made in closing of the value of farm loads for improving the diversity-factor in the daytime and of bakeries for the same purpose at night.

Wiring Costs and Methods

Under the chairmanship of Mr. R. S. Hale, of the Edison Electric Illuminating Company of Boston, the committee on wiring of existing buildings presented an exhaustive report advocating a standard price list for wiring service in existing buildings. The committee believed that the advertising and soliciting of business as well as the consultation with the prospective customer as to his particular needs should be undertaken by the central stations but that the actual wiring should in general be turned over to contractors. The advantages of a standard cost list with various changes and discounts to suit local conditions were emphasized. The several items entering into this class of wiring were investigated and estimates of cost were obtained from a large number of contractors in various sections of the country. An attempt was then made to arrange these figures so that they would represent average prevailing conditions and a standard list, in which provision was made for a 50 per cent discount, was offered for criticism. Specifications for various classes of wiring were proposed, and an appeal was made for co-operation from the Underwriters in the matter of preventing large energy-consuming devices from being connected to lighting circuits.

Discussion

The paper was discussed by Messrs. R. E. Campbell, of Cleveland; M. S. Seelman, Jr., of Brooklyn; M. C. Osborne, of Spokane; T. I. Jones, of Brooklyn; W. A. Donkin, of Pittsburgh, and J. Lyon, of Chicago. Mr. Campbell drew attention to the drop as affected by poor wiring in buildings and showed how it militates against proper performance of apparatus and lamps rated at standard voltages. Mr. Seelman told of the plans followed in Brooklyn of getting old houses wired and on the Edison circuits. A "forty-nine-dollar" campaign was started, this including the cost of wiring, fixtures and lamps. No attempt was made to wire entire houses because the price was not high enough, but the living rooms were wired and deferred payments were accepted. In this manner many houses not otherwise procurable were connected to the company's circuits. As Mr. Jones afterward explained, the "forty-nine-dollar" propoganda was only a means of creating an interest, because inquiries were what the company desired. Solicitors and wiring contractors then suggested increases in equipment and outlets, with the result that 91 per cent of the inquiries resulted in wiring contracts, the average cost of which exceeded $100. Mr. Osborne said that the Washington Water Power Company by means of a cheap wiring campaign had connected up 750 houses, the average cost of the wiring being $15 with seven lamps connected. Fully four-fifths of the houses in Spokane are equipped with electric lamps. Mr. Donkin claimed that the Duquesne Lighting Company succeeded last year in wiring 1500 homes, of which 850 were cheap classes of dwellings and the average cost was $14 per installation, paid for in instalments.

Electricity on the Farm

As a portion of the report of the committee on electricity on the farm, the committee for the Eastern States under Chairman John C. Parker, of the Rochester Railway & Light Company, submitted an interesting account of the possibilities and progress made in the rural districts in the East. It was stated that of the Eastern States, New York, New Jersey and Connecticut, on account of their population density, are conceded to offer the most promising field for exploiting electricity in the rural districts. In these States, where intensive crop developments obtain and where the truck grower and the orchard owner find a large market close at hand, the opportunity for extending the transmission lines to supply energy for the various wants of the farmer is thought to open a field which will primarily concern the smaller companies. Owing to the relatively large number of small farms in the East, developments will consist in the service of small units, making it essential that the investment made by the station per customer be kept to a minimum. The introduction of the more efficient protective devices and of bi-metallic wire, making possible longer spans, give considerable encouragement along this line.

The installations on the farms themselves should be

rugged and precaution should be taken to make them as "foolproof" as possible. In this connection the polyphase induction motor is thought to offer the best solution of the problem, because it is low in first cost and gives comparatively little trouble in operation. Technical efficiency should be considered as secondary to convenience, reliability and low cost.

A central-station company in inaugurating a campaign among the farmers of its district should be very careful not to arouse enthusiasm and create a demand for electric service in communities where it is unable to meet the demands immediately. Circularization of the immediate vicinity in which it has been determined to exploit the service is thought to be the correct way to bring to the attention of the rural residents the intentions of the company to establish the service. The use of a trial installation at the expense of that company and the services of a good wide-awake motor-service solicitor who is able to follow up the work launched by the circulars and close the contracts while the results of the trial installation are still fresh in the minds of the community will be found to add greatly to the success of the campaign. Too much attention cannot be given to the selection of the man who will have charge of this work; for he must be able to talk to the farmer on a dollars and cents basis as the farmer of to-day is a wide-awake business man.

The value of the farm district load to the central station is a point which will arrest the attention of all who study the difference between their summer and winter load curves. As an instance it may be cited that a Western plant which is now serving a farming community has actually been able to transfer its period of maximum demand from the winter to the summer months.

At the last two annual conventions optimistic reports have been presented upon the subject of electricity in rural districts. The sub-committee for the Central States of the committee on electricity on the farm, of which Mr. C. W. Pen Dell, of the Public Service Company of Northern Illinois, was chairman, has made a less optimistic report, an abstract of which is given below.

As a rule the income to the central station from the farming business alone as developed in the Central States at present does not justify the expense necessarily incurred in securing the farm load. It follows that some reason other than the farming business must be found for extending lines across the country and the farm business must be considered as a by-product. Data collected upon the application of electrical energy to the work of the farmer show that in practically every daily task there lies the possibility of a motor installation. Cost of production and the time necessary for getting crops upon the market may be reduced to a considerable extent when manual labor is as nearly dispensed with as possible. The data on cost of motor operation in different duties on the farm shed much light upon the feasibility of the idea from the farmer's point of view.

Besides farming itself there are other industries prevalent in the rural districts which deserve attention. Chief among these are irrigation and drainage projects, coal mines, stone quarries, brick and tile works and cement plants. Although it is appreciated that all central stations do not have these industries in their territory, each company has some of them or still others more promising. The data gathered by the committee show that in each of these industries lies an opportunity for an installation of 300 kw or more.

The problem of obtaining the heavy capital investment necessary to acquire farm business may be met in one of several ways. In some communities the farmers have financed local distribution systems of considerable size, taking energy from a cross-country transmission line and retailing it among themselves. In other places farmers have willingly paid the whole or a part of the cost of erecting the distribution circuit. In still other instances the central-station companies require a yearly minimum guaranteed income which is commensurate with the cost of the necessary extension. Outdoor substations and copper-clad steel wire are admittedly large factors in reducing the cost of rural extensions.

In spite of the various means which have been resorted to in order that a part of the investment cost may be shifted from the central station, it is the opinion of the committee for the Central States that the farming business as developed at present does not furnish returns commensurate with the capital investment.

The report of the committee of electricity on the farm for the Western States, of which Mr. S. V. Walton, of the Pacific Gas & Electric Company, of San Francisco, was chairman, indicated that there is a wide use of electricity for irrigation and other farm purposes in Washington, Oregon and Colorado. The same method of distribution obtains in all three States, there being a primary line feeding energy over the district at 11,000 volts. Previously the practice was to have the customer furnish the transformer and pay for the costs of the line used in reaching him; but now he is asked to pay for the motor only. This has resulted in making electricity popular. From the returns to the questions asked by the committee it developed that there is a very wide difference in the rates for this service. The irrigation and pumping loads extend from April to October, and the committee recommended that the smallest installation be made so that it will be required to operate over many hours. In this way the demand is kept down and the load-factor is increased, without any loss in economy of pumping.

Discussion

The reports by Messrs. J. C. Parker, C. W. Pen Dell and Stanley V. Walton were presented consecutively and discussed together. Supplementing Mr. Walton's report, Mr. S. M. Kennedy, of the Southern California Edison Company, Los Angeles, gave an account of the wide use of electricity in rural communities in California. The principal load comprises pumping for irrigation, there being no rain in California for six months of the year. The rating of the transformers used is for the most part 2 kw, and the reduction from 22,000 volts to 220 volts is made in one step. The rates charged for energy are the same as those which obtain in the city.

In displacing the gas engines previously used for pumping service the company found it expedient to purchase and dispose of them through a subsidiary company for about as much as it paid for them. In this way 7000 hp in gas engines was sold last year, and this year it is estimated that 1000 hp in old gas engines will be similarly disposed of. Mr. M. C. Osborne, of the Washington Water Power Company, Spokane, said that this company extended its lines into sparsely settled rural communities by making long-term contracts with the towns. All the houses are wired before the extensions are completed so that the load can be closely approximated. An experiment is now being tried with the object of reducing the cost of the service to the company to a minimum. A man visits the communities periodically in an automobile, reads the meters, makes out the bills and collects the amount then due on the account during the one visit.

Mr. Thomas Kelley, of the Dayton (Ohio) Power & Light Company, called attention to the possibilities of village lighting and water pumping such as is done outside of Dayton. Farmers afterward receive energy from these lines and many of them used electricity for cooking in summer. At present there is being installed as an experiment on a farm 6 miles south of Dayton an electric stimulating outfit, high-tension static interrupted electricity being used to improve plant growth. Last fall a similar experiment on a much smaller scale was tried with the result that radishes

twice as large as those grown ordinarily were obtained from a box stimulated by electricity. Mr. E. P. Edwards, of the General Electric Company, said that farm business at present is unprofitable, but the problem is not one of to-day but a problem of the future.

Mr. M. O. Dell Plain, of the Syracuse (N. Y.) Lighting Company, outlined the experience of his company in rural business. The rates are the same as those in the city, and the business thus far has been chiefly lighting. Energy is distributed at 11,000 volts primary with long secondaries. Mr. L. H. Scherck, of the Central Hudson Gas & Electric Company, of Poughkeepsie, N. Y., said that in extending the service to reach brickyards, stone crushers, villages and highways the farming load can be made an adjunct of the other business. His company is now making experimental installations on a number of farms chiefly as an advertisement.

Messrs. S. H. Wallace, of St. Louis; S. M. Kennedy, of Los Angeles; M. Mast, of Peoria; F. V. Underwood, of Birmingham, and C. W. Pen Dell, of Chicago, joined in a discussion as to methods adopted in making extensions. In Peoria the farmer pays 25 per cent of the cost, furnishes poles and cross-arms and gives permission to cross his property to reach farms beyond. The average income from farm service, which is chiefly a lighting load, is $27 a year. In Los Angeles extensions are made free of cost if the income is 40 per cent of the line cost the first year. In Birmingham extensions are made to coal and iron mines if from 20 to 30 per cent of the cost of the line is obtained in sales during the first year. Mr. Pen Dell outlined three systems of charging for extensions and also described some loads easily secured in rural communities, such as pumping water for railroads by automatic apparatus, which dispenses with the services of a man, operating railway signaling systems and introducing hoists, etc., in gravel pits.

Switching Apparatus for Rural Installations

In view of the increasing importance of outdoor substations for certain classes of service the paper on switching apparatus for rural installations by Mr. E. B. Merriam, of the General Electric Company, is of interest. This type of equipment is applicable to many other industries besides farming which are now using isolated plants that are being operated with little thought of economy. A list of the industries to which these so-called rural installations may be made applicable was included in the paper. A table of minimum economical sizes of installation for various line voltages was also given. Portable substations for supplying energy to contractors, farmers and other consumers whose apparatus is being continually moved from one place to another were described and illustrated.

A modified lever switch provided with a mechanism for raising and lowering the blade in a vertical plane was said to offer many advantages over the other types of primary switches. Regarding primary fuses the author expressed the opinion that the horn-gap type of fuse is not so well adapted to this class of work as is the tube explosion fuse.

The secondary switching and measuring apparatus for a rural installation usually consists of disconnecting switches, automatic oil switches or fuses, watt-hour meters and instrument transformers. This portion of the equipment is generally housed in a steel or wooden switch house to prevent it being tampered with. Several switch houses of this type were described and illustrated.

Pole-top regulators were commended by the author for use on circuits where it is desirable to maintain constant potential. He described a regulator of the induction automatic type and stated that it was capable of controlling the potential of a 10-amp feeder from 10 per cent below to 10 per cent above normal voltage. Portable generating equipments for break-down auxiliary service, temporary peak loads, construction work for installation during rehabilitation of old stations and for assisting in new-business solicitation were mentioned as a part of the operating equipment which should form an efficient and useful auxiliary for all transmission operators.

The Electric Vehicle

A paper enthusiastically presenting the case of the electric vehicle versus all other forms of central-station revenue getters was read by Mr. Edwin E. Witherby, of the General Vehicle Company. It is the opinion of Mr. Witherby that the electric vehicle offers an opportunity to the central station that is unsurpassed by that of any other source of revenue which the central station now has. Until every representative of the new-business department of the central station begins to realize that in every load of merchandise which passes him on the street there is an opportunity for the sale of electrical energy he will be overlooking one of the best sources of off-peak revenue which he would be able to secure for his company.

The policy of preaching the electric vehicle to prospective customers was recommended, but the further policy of practising what was preached was emphasized to a greater extent. The typical load curves which were shown in the paper well illustrated what is being done by the companies which have already begun to realize the importance of the electric vehicle load. Instances and data cited from the leading express companies and from the largest central stations in the country prove without a doubt that the electric truck is effecting a great saving for both the owner and the company which furnishes the energy.

The off-peak character of the electric-vehicle load was mentioned and the load curves of several garages serving both pleasure and commercial vehicles were given. It is a notable fact that practically all of the demand for changing energy is made at times when the demand from all other sources is at its lowest or is rapidly falling off. The practice of boosting at the noon hour was cited as the only way in which the depression in the load curve of the central station which occurs at that time can be filled.

Data on commercial vehicles in Chicago showed that the number of electric trucks had increased from 80 in the year of 1910 to 647 in May of 1913. In closing Mr. Witherby stated that, having convinced every live merchant, the large express companies and the entire brewery industry of the economy of the electric truck, it is his hope and the hope of all of the manufacturers that in the near future all of the central-station men will see the opportunity which is being offered to them and will co-operate in exploiting the electric truck.

Discussion

Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, said that his company has taken upon itself the responsibility of pushing the sale of electric vehicles, but regrets that it has had to do so because considerable expense and trouble are involved. However, at present there is lacking an effective system of selling electric cars, so that active central-station co-operation with the manufacturers is necessary. He described the garage opened by his company and stated that through its activities over 100 electric vehicles have been introduced into Baltimore. That not more electric-vehicle manufacturers are locally represented is a cause for regret, because there are about fifty gasoline-car salesmen in the city willing to sell gasoline trucks at little or no profit.

Mr. W. H. Blood, Jr., of Stone & Webster, Boston, Mass., discussed the importance of central-station companies preaching what they practise. Too little is said, he declared, about the success attending the use of electric vehicles.

Mr. J. C. Parker, of the Rochester (N. Y.) Railway & Light Company, voiced the desirability of employing loaded synchronous motor sets in garages for power-factor correction purposes, and also the justification for central-station companies taking care of garages as a legitimate

part of the business. He called attention to the performance of electric vehicles in governmental service at Washington, as described in a paper prepared for the convention of the American Society of Mechanical Engineers by the superintendent having charge of that work, and suggested that an investigation be made into the conduct of garages with a view to bettering conditions.

Mr. F. W. Smith, of the United Electric Light & Power Company of New York, regretted that the author unintentionally "knocked" the central stations of the country in stating that over 60 per cent of them showed no interest whatsoever in the electric vehicle. He insisted that central-station companies do support the electric-vehicle movement and stated in abstract the plans of the publicity committee of the Electric Vehicle Association of America.

Mr. F. D. Beardslee, of the Union Electric Light & Power Company, St. Louis, related the practice followed by that company in nursing the electric vehicle and then giving up its garages as soon as the use of the vehicles was well established and good garages owned by private companies were available.

Mr. R. S. Hale, of the Boston Edison company, doubted the wisdom of installing synchronous-motor-generator sets if the business is off-peak, but Mr. Parker stated that in Rochester, N. Y., the sets in garages are used twenty-four hours a day.

Mr. G. B. Tripp, of the Harrisburg (Pa.) Light & Power Company, told of the advantages of the electric-vehicle load as affecting the load-factor of stations.

Mr. T. I. Jones, of the Brooklyn Edison company, questioned Mr. Parker as to the rates charged in Rochester for garage service. Mr. Parker said that where the owner furnishes his own apparatus the rate is 1.2 cents per kw-hr., and that where synchronous motor-generator sets are installed by the company it is for the advantages derived by the company.

Mr. S. M. Kennedy, of the Southern California Edison Company, Los Angeles, Cal., said there could be no doubt of the advantages of the electric-vehicle load, and that the way to obtain the load is for the central stations themselves to use the vehicles. He did not advocate electric vehicles for long-distance runs, but he did insist that the electric-light company should support the business by example.

A representative of the Denver (Col.) Gas & Electric Light Company told of what was being done in his city, and Mr. E. F. Lawton, of the Hartford (Conn.) Electric Light Company, gave the practice of his company, which owns the batteries and sells the service.

Mr. F. L. Morgan, of the Standard Electric Car Company, of Jackson, Mich., commented on the impression of the previous speakers that electric trucks are all-important, whereas the possibility of a low-priced electric pleasure car has not had any consideration. He said that statistics show that there are 4500 families in the United States with annual incomes ranging above $15,000 and 700,000 families with incomes of from $5,000 to $15,000. The latter class would be interested in a pleasure car selling for less than $2,000 and also in the economies attending the use of electricity as the motive power. In summing up, Mr. Witherby said investigation had convinced him that 75 per cent of the central-station managers in the West are hostile to electric vehicles, and that little development will take place in any territory where the electric-light company is entirely neutral.

Electric-Railway Loads for Central Stations

Because of its notably good load-factor and power-factor and its effect in improving the diversity-factor, the electric-railway load, both urban and interurban, was pointed out in a paper by Mr. E. P. Dillon, of the Westinghouse Electric & Manufacturing Company, to be a particularly good one for the central stations to obtain. The facts that it represents a large block of energy sold to one customer, that it is generally a growing load, and that the customer is one of known credit, were stated to be additional advantages in favor of this load. A number of instances were cited, mainly in the larger cities, where the railway systems are operated by central-station energy. It was shown that, important as this demand is, its requirements are overshadowed by those of the lighting and motor loads, so that, although 25 cycles is a very desirable frequency for traction purposes, the 60-cycle frequency required for lighting and ordinary motor loads is nearly standard. A simple and interesting chart was given, showing that the railway peak occurs at all seasons from about 5:30 to 6 p. m., while the lighting and motor peaks occur between 4 p. m., at the end of December, and 7:30 p. m., at the end of June, depending on the length of day at the various seasons. Leaving out of consideration, then, those days that are dark through stormy or cloudy conditions, there are only two periods of less than a month each per year—that is, at the end of March and at the end of September—when the railway and lighting peaks are likely to occur at the same time. Finally, it was stated that a very considerable advantage gained by the combination of the lighting motor-service power and the railway loads consists in the ability to use larger generating equipment, with its increased efficiency.

Central-Station Service in Coal Mines

In a paper by Mr. W. A. Thomas, of the Westinghouse Electric & Manufacturing Company, were presented many interesting points in regard to the relation between central stations and coal mines, and some recent agreements in regard to energy supply were cited. Though many coal mines are in close proximity to central stations, not until rather recently did the central stations take up the subject of electric mine operations. Recently some stations have been built close to coal mines for the primary purpose of supplying energy for mines.

The author confined his discussion to bituminous coal mines. He presented some figures relating to mine operation derived from investigations in various parts of the country. A study of fifty-six mine plants in West Virginia showed an average of 200 kw installed, with an average load-factor of 26 per cent. The average equipment cost was found to be $80 per kw-hr. installed. Ten mines in Ohio having an average output of 21,500 tons each per month, with an isolated power plant at each, showed an average cost of energy of 2.553 cents per kw-hr. The average load-factor for a twenty-four-hour working day was 32 per cent, but the average number of days was only fifteen and one-half per month, resulting in a thirty-day load-factor of 22.5 per cent. The average consumption per ton mined was 2.3 kw-hr., but in this case the fans and the main pumps were driven by steam. In considering the question of supplying central-station energy to these mines it was necessary to figure on disposing of old apparatus, and the rate for central-station energy, without service charge, was in this case set at 1.733 cents per kw-hr.

A typical case as to results in mining operation with central-station energy is cited in a shaft operating in the Middle West where practically all of the mechanical operations were carried out electrically, including replacing a steam hoist with an electric hoist. In 1911 with steam operation this mine produced 82,000 tons of coal and used 1800 tons, or 2.3 per cent, for fuel, with a value of $1,800. In 1912 with electrical operation, including the hoist, the production was 105,000 tons, with an energy bill of $2,362, or 2.24 per cent of the average value of the coal hoisted. It is evident from this that the energy bill equals only the normal value of the fuel used in steam operation, with a complete saving of the labor of firing the boilers and a very material reduction in the fixed charge on the cost of power plants as compared with the substation equipment.

The author emphasized the importance of the representative of the central station having a more or less thorough

working knowledge of mine operations and understanding of the elements of cost entering into the matter of coal production. On the other hand, he must also be able to make the customer understand the conditions of operating central-station plants in order that he may have confidence in the ability of the central station to continue for a long period to furnish energy at the rates quoted.

In new developments the factor decidedly in favor of central-station service is the reduced investment on the part of the mine operator in substation apparatus as against an isolated generating station. In many instances the central-station company has even found it desirable to make the investment for the substation, allowing the mine operator to pay for it in instalments with a reasonable interest, or to retain the substation equipment and allow the mine operator to pay a reasonable interest and depreciation on the investment. A notable case of this kind is a contract made by the Centerville Light & Traction Company, of Centerville, Ia., for furnishing energy to coal mines some 8 miles from the central station, installing the necessary step-down transformers and 2200-volt motor-generator sets, the energy being metered at 2200 volts before it enters the motor-generator set. The coal companies furnish the building and the central-station company furnishes the apparatus and charges a rental of 15 per cent per year for the use of this with an option to purchase at any time less the amount attributable to depreciation, which is figured at 9 per cent per year. The power company constructs the transmission line to the coal mines upon an agreement with the coal companies of a minimum bill per year.

In conclusion, the author expressed the opinion that central stations located in the proximity of coal mines have a most attractive market for energy, especially where combined with a general lighting and motor-service load, and again emphasized particularly the necessity of understanding the mine operator's conditions.

Discussion

The paper was discussed by Messrs. W. H. Thomson, Jr., of the Des Moines (Ia.) Electric Company, and D. B. Rushmore, of the General Electric Company. Mr. Thomson inquired as to mining regulations calling for reserve supply for fans in case of failure of the main circuit, but none present could enlighten him. Mr. Rushmore stated that in the Pocahontas coal regions, where every pound of coal is marketable, no trouble was experienced in selling hydroelectric energy to mines. He described a method of induction motor control in which a converting set is connected in the secondary circuit of the motor and returns energy heretofore wasted in resistance to the line.

Central-Station Ice Making

The report of the committee on refrigeration, of which Mr. George H. Jones, of the Commonwealth Edison Company, Chicago, was chairman, contained a short outline of the theory of refrigeration. The two systems, the compression system and the absorption system, were explained in detail and the various methods of applying each system were described. The method of estimating the size of the machine to be used for various purposes was explained, and recommendations were given as to the factors to be considered in such calculations. The committee particularly emphasized the qualities of the so-called Audiffren type of refrigerating machine recently placed on the market and described in the *Electrical World* of March 8.

In regard to central-station ice making the committee considered the practicability of central-station service for this class of business to be beyond doubt. Investigations made by the committee proved it to be a most attractive field, as these plants generally require the use of between 100,000 kw-hr. and 200,000 kw-hr. per month, particularly during the summer months. The 2000 steam-driven ice plants in the United States would, if operated by central-station service, consume from 600,000,000 kw-hr. to 700,000,000 kw-hr. per year. The number of electric plants has been increasing steadily, and the probabilities are that the increase will continue. Though no general rule can be laid down in regard to rates and other factors entering into the energy supply, it seems that central-station companies should be able to secure practically all of the new ice plants which will be constructed in the future. The particular advantages of electrically operated ice plants are that they may be built at or near the center of distribution irrespective of railroad facilities. It is a well-established fact that a very large item of cost in the ice business is that of delivering to the consumer. The ideal arrangement would be to install plants of 80-ton to 100-ton capacity about two miles apart, so that each plant could supply ice for the territory within a radius of a mile, thus reducing delivery to a minimum. Another point of advantage which is also a well-established fact is that better ice can be produced in an electrically operated than in a steam-driven plant, as the trouble frequently encountered in steam-driven plants of having oil carried over from the engine cylinders is entirely eliminated.

A number of points were given as to methods for securing ice business. In this connection the committee presented a few facts concerning the quality of water which had important bearing upon the manufacture of ice and also advised as to the system to be used under different water-supply conditions.

The committee pointed out that the successful operation of an electrically driven ice plant is primarily dependent upon the equipment installed, an important part of which is the motor drive. In all plants thus far constructed three-phase alternating current is used. The opinion of the committee is that slow-speed, slip-ring, induction-type motors and drum controllers should be used. In case constant speed work is desired the resistance of the resistors to be furnished with the controller need be large enough simply for starting the motor. If variation of the speed should become desirable, the only change required would be to install additional resistors.

The use of multiple-speed motors has been suggested for this class of work, but it is the opinion of the committee that this practice should be discouraged as the efficiency of the motor at full load is not quite so high as that of the standard motor, and, furthermore, the power-factor is considerably lower.

The question of superiority of the steam and electric plants the committee answered in the words of one of the largest ice operators in the country, who has a number of distilled ice plants of both types. He states that under his conditions of operation there is practically no difference in the cost of manufacture under the two systems. Under the electric plan of operation, however, he can locate plants in a way to suit best his needs, and, furthermore, the possibility of contamination from oil is removed, which is a point of value.

A particularly valuable feature of this report was an appendix containing a long list of refrigerating plants for various purposes, such as for office buildings, wholesale meat markets, provision dealers, residences, hospitals, packing houses, florists, drug stores, candy factories, groceries, dairies, restaurants, fur stores, hotels and others. In all, seventy-five plants were specified. For each plant were given the refrigerating equipment of electric motors, refrigerating machines and other particulars which may be of interest. There were also a number of specifications of ice-making plants which are of great interest, each one of these containing complete data as to time of operation, rated daily output, annual output, energy consumption by month of the year, connected horse-power, number of motors, average consumption per month per connected horse-power, consumption per unit of manufactured product, and the maximum demand in kilowatts of the plants. The mechan-

ical and electrical equipment of the plant was outlined in each instance.

Discussion

An interesting discussion followed the reading of the report, Messrs. H. Cochran, of the Carbondale Machine Company's Chicago office; T. I. Jones, of Brooklyn; R. H. Tillman, of Baltimore; L. H. Egan, of Kansas City; J. P. Pope, of Lexington, Ky., and E. W. Lloyd, of Chicago, participating. Both Mr. Cochran and Mr. Pope spoke of the excellent results attending the use of exhaust steam in making ice as a central-station by-product. Mr. Jones told of two raw-water ice plants which the Brooklyn Edison company had recently connected to its circuits. In order to secure the load the rates were based on a yearly load-factor with a minimum guarantee. In work of this kind Mr. Jones pointed out that the expense of ice making is chiefly in the distribution costs. The haulage of coal to the ice-making plant and the delivery of the manufactured product are items of importance. In Brooklyn the plan of the ice manufacturers is to establish numerous small plants so as to minimize the cost of delivery of ice.

Mr. Lloyd related his experiences with ice-making loads in Chicago. Ice-manufacturing plants, he said, have a yearly load-factor ranging from 50 to 60 per cent in the Chicago districts, the former figure being more nearly the average, although monthly load-factors of 75 per cent will be guaranteed by the manufacturers from April to October. The maximum demand is governed very largely by the humidity in the summer time and is highest when it least affects the system. No manufacturer using steam-driven refrigerating apparatus knows exactly what his costs are, and if he did he would never admit that electricity effects any saving. However, more and more electrically driven raw-water plants are being installed. The electric meter measures exactly the consumption of electricity so that the cost of production can be determined with precision. It is possible to reduce the cost per ton by employing more cooling water. The ratio giving most economical results must be determined for each specific case. Where water is cheap the energy used per ton is least.

CENTRAL-STATION STEAM HEATING

The work of the committee on steam heating, of which Mr. S. Morgan Bushnell, of the Commonwealth Edison Company, Chicago, was chairman, was largely devoted to the securing of data on cost of heating by steam and hot water, relative merits and demerits of the two systems, use of waste heat from gas and oil engines, and the relation between the steam and electric loads in large buildings as affecting the question of using exhaust steam for heating.

The committee did not express any definite opinion as to the profitableness of the steam-heating business, though it holds an optimistic view on the matter and expresses the belief that a more satisfactory showing on a dollars-and-cents basis will be achieved with further experience and information concerning the various elements entering into the business. As a caution the committee points out one error often made by steam-heating companies in extending their piping systems too far, with the consequent result of a large investment and excessive operating expenses on which they are unable to earn returns.

In order to compare the two systems of steam-heating and hot-water heating the committee presented in tabulated form the arguments for each system from both the company's side and the customer's. In regard to methods of charging, it seemed to be the unanimous opinion that the meter rates should be used as far as possible. Single-rate and two-rate systems were discussed and experiences with both systems referred to. The single-rate measure system with a sliding scale of rates based on the amount of the meter readings was recommended for the small customers.

The subject of using waste heat from gas and oil engines for heating purposes is by no means a new one, though little has been written about it. In fact, attempts were made more than twenty-five years ago along these lines. There are two distinct methods of utilizing this waste heat: (1) Heating water by means of exhaust gas, either by raising the temperature of the water discharged by the jackets of the engine or raising the temperature of other water, such as that in a closed hot-water-heating system, without making any use of the heat in the jacket water, and (2) raising steam by means of the exhaust gases, using as boiler feed either the jacket water or other water, with no attempt to utilize the heat contained in the jacket water. The merit of each method and the application for various purposes were explained. Several curves were presented to show the amount of heat available, the distribution of heat in an oil engine and the results of test upon an exhaust heater connected to a 200-hp gas engine. There are a number of reasons for the very limited extent to which the heat in the exhaust and in the jacket water has been utilized for heating buildings, the most important one being the comparatively small amount of heat available from these sources compared with the amount present in the exhaust of a steam engine carrying a similar load. The approximate number of pounds per kilowatt-hour available from various types of prime movers is as follows: Simple automatic engine, 60; single-cylinder Corliss engine, 42; Corliss non-condensing compound engine, 33; gas or oil engine exhaust used for raising low-pressure steam, 3.

An interesting study was made by the committee on the relation between steam and electric loads in buildings devoted to a great variety of purposes as affecting the question of using exhaust steam for heating. Typical curves for different types of buildings were reproduced. The curves showed that even in the winter time, when the heating and motor-service requirements more nearly approach each other, there is still a wide variation in the two curves, at certain periods of the day the demand for steam for heating being far in excess of the demand for electricity, while at other periods of the day the demand for electricity is far in excess of the demand for heating. In view of the fact that the steam demand for heating disappears altogether in the summer and in the winter is not at all coincident with the demand for electricity, it is readily seen that the utilization of exhaust steam for heating in isolated plants is not nearly so great a factor in economy as has sometimes been claimed. There is also a considerable variation between different buildings, the lack of co-ordination being much more marked in some than in others.

Discussion

Messrs. W. R. Collier, of the Georgia Power Company, Atlanta, Ga.; L. H. Scherck, of Poughkeepsie, N. Y.; S. Bolton, of Aledo, Ill., and E. F. McCabe, of Titusville, Pa., joined in the discussion of Mr. Bushnell's report. Mr. Collier called attention to a peculiar situation brought about by advances in the art. His company supplies steam heat in Atlanta from a steam-driven electric station, but recently it has gone extensively into hydroelectric development, so that the steam station is seldom used. It is cheaper to generate electricity by water than by steam, but it will be necessary to run the steam station during the heating period or use steam directly from the boilers. If high pressure must be carried because of the severity of the weather the profits will entirely disappear. Mr. Scherck said his company also has a white elephant on its hands for the same reason, but as a means of keeping isolated plants out of Newburgh, N. Y., where the plant is located, it is worth while to keep the system in operation, even granting that the public would consent to having the service withdrawn. Mr. Bolton, who contributed much of interest to the discussion, stated that in Aledo, with 3000 inhabitants, steam heating is a profitable proposition. There the mains are not laid in the streets but are run from building to building through the basements. It is an easy

matter to get at the mains at any time. Magnesia is used for insulation. A flat rate of $4 per 1000 cu. ft. of radiation per year is in vogue, and a meter rate of 40 cents per 1000 lb. of condensation is charged. The income from the heating load is a trifle more than the cost of the coal.

Relations with the Public

Preventing Panics

An important feature of the first commercial session was an address by President David R. Forgan, of the National City Bank, Chicago, on "How to Protect Business from Disturbances Caused by Panics." A large and representative audience cordially greeted the speaker, who was introduced by Past-president Samuel Insull, and at the close of the address much enthusiastic appreciation was displayed. Mr. Forgan explained, with great clearness, the functions of credit in modern business; discussed the disadvantages of the present American banking system, and reviewed the recommendations of the National Monetary Commission, whose exhaustive work in the past three years points the way toward the establishment of a flexible financial system in the United States. The commission finds that the country's currency lacks elasticity; that mobility of reserves is needed; that the American business world lacks liquidity of bank assets, and that the centralization of banking power closely allied to the national government is a vital essential in bringing our banking system up to date and establishing country-wide safeguards against rigid monetary conditions unresponsive to the legitimate demands of business in critical periods. In a comprehensive outline of the commission's recommendations, Mr. Forgan described the functions of the suggested National Reserve Association of the United States, which it is proposed to form through the united action of all the state and national banks of the country which care to come in and can qualify for membership. This great bank will also be the fiscal agent of the government, having possibly three hundred millions of capital, holding the reserves of the banks and having large power in issuing notes redeemable in the national money. As a great central reservoir of reserves it will act as a powerful agency against monetary stringency, and if established along the general lines recommended by the commission will go far toward making panics in the United States as rare as they are in England, France and Germany, where a centralized banking organization, closely allied to the government, insures stability and confidence throughout the nation.

Mr. Forgan explained that there is little to fear in such a centralization and that the contention that by this scheme Wall Street is seeking to control all the money in the country is beside the mark. The truth is that it is proposed to transfer the control from Wall Street to Washington, from the hands of the private banks to the hands of all the chartered banks of the country, with the closest governmental relations. Closing, the speaker urged the united support of business men on behalf of the proposed reform, which will put this country on a level with its largest competitors in this great matter of national and international credit.

Conservation of Natural Resources

In a paper entitled "The Failure of Conservation to Conserve," Mr. E. H. Thomas, of the *Post-Intelligencer*, Seattle, Wash., attacked the Bureau of Forestry of the Department of Agriculture, claiming that it is hostile to development, especially in Alaska and in the Far West, and thus instead of using without wasting has wasted without using, which of course is not conservation in its broadest sense. He showed the difficulty experienced by private companies in obtaining water grants in the National Forest Reserve because the regulations are prejudicial to investors, and stated that it is time for the country to place the administration of the public domain on a business basis. This, he said, can be done by employing practical business men to carry on the work instead of theorists and politicians. The latter, he held, have brought conservation into disrepute and made it odious to the Northwest, which suffers most from the existence of an undeveloped and unprofitable wilderness.

Discussion

Mr. D. B. Rushmore, Schenectady, N. Y., discussed the problem of conservation broadly, touching upon the new economic problems of hydroelectric development, whose difficult solution has tended to create more or less inactivity. Lack of understanding of the situation is largely responsible for the slow unfolding of public policies regarding hydroelectric developments. A campaign of education is needed to bring the facts to public appreciation. Closer connection between the public and its governmental representatives is essential in order to secure adequate development.

Literature on Electrical Subjects

In the report of the committee on publications, of which Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, Baltimore, was chairman, a record was given of the year's work in the distribution of literature on electrical subjects. Of the publications completed by the previous committee there were sent out during the season of 1912-13 up to the end of March, 1913, 165,930 copies on the following four subjects: "Electric Service in the Home," "Electrical Equipment of the Home," "Industrial Lighting" and "Ornamental Street Lighting." The committee reported also that it had been actively engaged in the preparation of new subjects and that before the expiration of its term of office there would be available for distribution literature on the following subjects: "Home Thoughts Electric," "Store Service," "Church Lighting" and "Electricity on the Farm."

The usefulness of this service especially to the smaller companies was dwelt upon, and an appeal was made for more interest in it from both the large and the small concerns among the members. It was stated that so far during the year the orders for this literature had come from eighty companies, while there are about 1300 Class A members in the association to whom the service is open. The work of the committee during the past year had fallen under three general heads—(1) supervisory, in looking after the stock of the various publications, their sale and delivery; (2) constructive, in the sense that it had undertaken the preparation of new matter, and (3) commercial, in that one member of the committee had acted as sales manager to arouse interest in the several publications. The N. E. L. A. monthly *Bulletin* was used during the year for advertising purposes. In closing, the committee recommended that the work be carried on next year under a new committee and that, owing to the large amount of time required for it, appointments be made on the basis of working membership.

Discussion

In opening the discussion on the report of the publications committee, Mr. T. I. Jones, Brooklyn, N. Y., pointed out how large a number of the company members of the association are still unfamiliar with the good work being done by the committee. He emphasized especially the value of using the committee's literature in inaugurating commercial campaigns, declaring that the finished work of experts is thus made available to small companies at a cost for which even the mere printing could not be duplicated in small quantities.

Mr. F. H. Gale, Schenectady, N. Y., while complimenting the products of the publications committee, questioned what

could be lacking in its methods that only 80 out of 1300 company members had availed themselves of the literature offered. In reply, Mr. M. L. Turner, Cleveland, Ohio, suggested the use of more intense salesmanship in distributing the publications themselves.

Mr. M. S. Seelman, Brooklyn, N. Y., called to the section's attention the fact that several of the most popular and valuable publications of the committee had been issued only during the past few weeks. These booklets on store lighting, church illumination and farm service will doubtless shortly enjoy a large demand. Mr. J. C. McQuiston, Pittsburgh, Pa., spoke of the delay always encountered in launching new publications and predicted better success later.

Mr. C. W. Lee, New York, urged that dependence be not placed on sales literature alone, but that this material be properly used to supplement the personal efforts of central-station salesmen. Mr. M. C. Osborn, Spokane, Wash., said that distribution of sample copies of the publications to central stations would prove fruitless unless care were taken to make sure that they reached the proper hands in the first place.

Mr. E. F. McCabe, Titusville, Pa., thought the quality of some of the commercial literature "overdrawn" and said he found too many repetitions of the word "expert" in the pages he had examined to give the prospective customer a correct understanding of the simplicity of electric service.

Mr. John C. Parker, Rochester, N. Y., declared that no "canned" or syndicated literature could ever be as effective as material prepared locally with due regard for local conditions, even by a staff of ordinary skill. But the committee's publications, he insisted, contain much of real value, and he recommended that they be used where possible to inaugurate or supplement campaign literature produced locally.

Mr. S. M. Kennedy, Los Angeles, Cal., recommended that the committee subdivide some of its publications into a series of sections so that these might be sent successively to busy merchants and manufacturers. Mr. H. C. Sterling, Three Rivers, Mich., told of his own successful use of the printed material supplied by manufacturers.

Education of Salesmen

On the assumption that the central-station salesman is indirectly the means of disposing of manufacturers' products, and that the immense field of new business requires men having all-around training, capable of taking care of a district and meeting intelligently any local conditions without recourse to the home office, the committee on education of salesmen, of which Mr. George Williams, of H. L. Doherty & Company, New York, was chairman, carried on investigations to bring out the proper qualifications necessary in such a salesman. Eleven general characteristics are specified, and then, by way of elaboration, the committee quotes passages culled from various sources. One of the first essentials mentioned as a prerequisite is for the salesman to believe he has something which it is right for the customer to use and of which he has need. Other qualifications necessary to success are an effective personality, good humor being a predominant characteristic, and the absence of a continual "grouch"; imagination also to a degree, and absolute honesty in statement. Salesmen need not be purely technical, but they should be loyal to the organization.

Many central stations have established schools for training their employees, and the methods employed in some of these are described at length. Textbooks recommended for study classes by the committee are also enumerated. The books cover a wide range of subjects, but the greater portion have a direct bearing on modern organization, business and salesmanship. To questions asked of representative men of the larger companies the answers indicate that the college man has the advantage over self-trained and self-educated men, that the best organization is secured by promotions from within, that from 75 to 100 per cent of the men employed by manufacturing companies are college graduates, and that from 5 to 15 per cent of the men in the central-station field are also college-bred. The subcommittee to which was referred the question of training by correspondence recommended that a course of instruction be offered to member companies only, and that the students should have no financial relation with the association. The plan of the course was outlined, however, only in a very general way.

Discussion

When starting in the new central-station salesman, Mr. C. A. S. Howlett, Schenectady, N. Y., proposed setting a trial period, at the end of which term, say six months, the candidate would receive $100 a month if he "made good." At the end of the first year this amount might be again increased to $125. In answer to an inquiry from Mr. B. W. Mendenhall, Salt Lake City, Utah, Chairman E. W. Lloyd, Chicago, Ill., explained that training at the Chicago Central Station Institute involves no obligation to continue employment later with the contributing companies. While the regular salesmen in Chicago are paid both salary and commissions, it is hardly likely, added Mr. Lloyd, that the newly graduated student-salesman could earn any considerable commissions during his probation period.

Mr. A. C. Einstein, St. Louis, Mo., declared that the qualifications required of men to sell electrical machinery are entirely different from those demanded of central-station salesmen. Similarly a given central-station man will be found to handle most easily some one class of residence, industrial or commercial sales. The classes of the Union Electric Light & Power Company's training school are similarly divided into the above three classes. The heads of departments, said Mr. Einstein, themselves need a comprehensive education, and can be of the greatest service in leading and directing the training of their employees. The speaker expressed doubt whether a universal scheme of training electrical salesmen would ever prove successful.

Mr. J. W. Ferguson, Chicago, suggested that some provision should be made for advancing office boys and junior clerks, in return for faithful service during years when they were denied opportunities for schooling.

Mr. F. D. Beardslee, St. Louis, said that his company requires every employee in the sales department to attend one of three classes of instruction. Advancement is awarded on a merit basis. A "point" system is in force based upon the kw of load secured, increase in revenue obtained, etc., credits being posted on a score board and bonuses awarded monthly to the five highest men. If desired additional points can be added for special classes of business when certain campaigns are under way. In this way the best men earn deserved advancement. Years of service are also taken into account in increasing salaries. The classes above referred to by Mr. Beardslee, and also by Mr. Einstein, are conducted by a "faculty" composed of the graduate sales engineers of the company. To pass from one class into the next the candidate must submit to an examination by a board of five selected from this faculty.

Mr. L. H. Scherck, Poughkeepsie, N. Y., contested that the central-station salesman in the small town or city must know a great deal more than the specialist with the larger company. It is very difficult, he declared, to secure capable "all-round" men for this class of small-town work, compared with the ease of getting specialists. The speaker approved most heartily, he said, the plan to conduct correspondence courses of instruction for the benefit of salesmen in the smaller companies.

Mr. R. B. Snyder, Milwaukee, Wis., also spoke briefly during the discussion.

Central-Station Advertising

Bearing in mind the fact that the best advertisement a central station or any other commercial organization can have is a satisfied customer, the report of the committee on advertising, of which Mr. J. Robert Crouse, of the National Quality Lamp Division of the General Electric Company, was chairman, asserted that 40 per cent of the arguments used by salesmen can be said, and said better, by advertising. This statement was intended to refer to the preliminary work only, since the actual closing of sales requires personal solicitation and can seldom be done, at least in this line, by the advertisement alone.

In order to secure efficiency, the responsibility for the direction of the advertising policy and activity should be definitely placed, and the closest co-operation should exist between the advertising and selling departments. The paper advocated either of two methods for determining the amount of the advertising appropriation—(1) taking a certain percentage of sales receipts of the previous year, (2) taking a certain amount for each unit of energy or merchandise it is planned to sell.

A section of the paper of distinct value was that in which was given an analysis of the several mediums and of what each is best adapted to carry. The ones mentioned were newspapers (morning, evening and Sunday), electric signs, letters, window displays, shows, fairs and demonstrations, theater programs, picture shows, billboards and street-car advertising. Particular emphasis was placed on the value of newspaper advertising for certain lines and also on that of direct mail solicitation. It was considered inadvisable to advertise for motor load, because of the comparatively few possible customers.

Essential qualities of good copy were then discussed, the principal items touched upon being ideas, arrangement, renewal frequency and seasonableness. Methods were suggested for the carrying on of special campaigns and co-operative advertising. House organs were acclaimed as an effective advertising medium, and it was advised that by supplying items of real news value to the newspapers a form of advertising not otherwise possible would be obtained. The report finished with the statement that the Commercial Section publications had been of much assistance in this field and were less expensive than the same material would be if secured anywhere else.

Supplementing his printed paper, Mr. Crouse also presented a bibliography of the twenty-seven papers on subjects of advertising which have been read before the National Electric Light Association since 1904.

Passing to some of the broader aspects of selling effort in the electrical field, the speaker pointed out that while increased efficiency had resulted in every other branch of the industry, the "selling cost" has shown no decrease during the past twenty years. With the electric-service companies of this country doing an annual business of $400,000,000, 5 per cent of which is re-expended in sales work; with the manufacturers and jobbers turning over $300,000,000 yearly, of which 15 per cent goes to selling expense, and with the contractors alone collecting some $100,000,000 annually, Mr. Crouse estimated that at least $15,000,000 is now being expended in competitive effort, and he urged the propriety of diverting some share of this toll of the "war of business" to a co-operative movement. Until the organization of the Society for Electrical Development, said Mr. Crouse, no forum existed where all branches of the industry might assemble and discuss their interrelated problems on an equal footing.

Discussion

Postponed from the session of the preceding day, discussion of the report of the committee on advertising opened the third commercial session, held Thursday morning.

Mr. N. H. Boynton, a member of the committee, declared that the present report was only "the start" of the pace which the advertising committee had set for itself. Heretofore much difficulty had been experienced in securing data of any kind relating to this subject. On two points in the report the speaker placed especial emphasis, urging (1) more serious consideration of advertising as an aid to sales work, (2) fuller realization of the fact that a salesman's time is too valuable to be spent in any work which advertising will accomplish at much less expense.

Mr. M. S. Seelman, Brooklyn, N. Y., observed that the matter to be found in the committee's report would prove of no less value to large central-station companies than to those in smaller communities. He complimented the report as being extremely practical and useful and declared that it represented the best compilation of its kind ever attempted, codifying as it did the experience of a number of companies.

Mr. C. W. Lee, New York, remarked that the report struck a new note in advertising. When considering individual pieces of literature, he said, attention should be especially given to their constructive use with other units in the same campaign. Mr. Lee recommended the use of newspaper space in presenting corporation policies to the public, and urged managers of properties to confide in and encourage newspaper men to visit their offices when in search of items of interest. A company might thus fortify itself in public opinion in a way that would prove extremely valuable in the event of labor, franchise or rate controversies.

Mr. T. R. Elcock, Jr., Philadelphia, Pa., reported his success in reaching wealthy residence "prospects" for electrical appliances, through return post cards attached to their gas bills. He had also made a practice of publishing in the local newspapers photographs of the stores of merchants who have good electrical installations. Public-service corporations, continued Mr. Elcock, need all the friendly public spirit they can earn.

Mr. W. D. McJunkin, Chicago, seconded Mr. Boynton in emphasizing the value of advertising for supplementing the efforts of salesmen. He quoted a recent address by Mr. Samuel Insull in which to the advertising campaign of the Commonwealth Edison Company was attributed much of the company's commercial development. During certain seasons, said Mr. Insull, this advertising, alone, keeps the full soliciting force busy answering inquiries. In closing Mr. McJunkin urged the need of expertly prepared advertising copy to obtain best results from space of any kind, and he described the benefits sure to result to the small central station from a co-operative advertising bureau.

Mr. T. F. Kelly, Dayton, explained that his company sometime ago adopted the motto, "If it isn't electric, it isn't modern." The force of this maxim had been so directed upon the local community that a Dayton landlord in recently advertising a dwelling for rent took care to state explicitly, "modern in all respects, *except electric light.*" A copy of this rental advertisement was later republished in the electric company's own display space and attracted much interest.

Indirect Advertising of the Electrical Industries

In a paper by Mr. J. G. Learned, of the Public Service Company of Northern Illinois, was discussed the tremendous influence of indirect advertising in the form of non-technical articles on scientific engineering and industrial topics. To any and all of these lines, he explained, there are two sides, one of commercial methods and practice and the other of visible results and bearing on the general welfare or community life. This last phase is one of human interest regardless of the training of the reader. The author expressed the opinion that effective publicity consists in the intelligent presentation to the public of this human-interest side. The electrical field, he thought, is especially rich in features of popular interest and of the sort that furnish excellent publicity material. He attributed

the wonderful growth of the electrical industry in no small measure to this indirect advertising. After citing examples of the class of literature which, through its wide appeal, has done much to spread a knowledge of the industry and arouse public interest in it, Mr. Learned closed with an urgent appeal to the central stations to push this class of publicity to its fullest extent.

Accounting Methods

PROGRESS TOWARD UNIFORM ACCOUNTING

The committee on uniform accounting, of which Mr. E. J. Bowers, of the Kansas City (Mo.) Electric Light Company, was chairman, reported that during the past year it had appointed sub-committees on public service relations, uniform classification of accounts, and statistics and forms. Because the accounting requirements of the several companies represented vary so widely, the committee was unable to agree on any form that could be recommended by the association to all member companies. It therefore decided to make a collection of forms now in use in the industry, and this second set has been arranged according to population of towns. The report contained also a record of the joint sessions held during the past year with the accounting committee of the Electric Railway Association and with the United States Census Bureau to pass on a new form for reporting the five-year census of the electric-lighting industry to the government. It was shown that while in the main the forms previously used by the Census Bureau were the same as those recommended by the association, there are still a number of points in which the former can be improved by adopting the classifications used in the latter.

It was stated further that some attention had been given during the year to an attempt to co-operate with the various public service commissions in an effort to secure standardized forms that would be of most service both to the government and to the companies. Still another line in which progress has been made during the year was explained in the report, where details were given of a meeting held in Chicago in February, 1913, at which it was decided to include in the report for 1913 a complete index by topics of all of the papers that have been read on accounting matters before the association. The topic heads chosen were general accounting matters, depreciation, purchasing and stores, work-order systems, meters and meter records, customers' accounts, collections, statistical, and miscellaneous, and in pursuance of this policy the report closed with abstracts of these papers.

Discussion

The report was discussed by Messrs. H. M. Edwards, of New York; H. W. Magruder, of Liberal, Kan.; W. W. Denner, of Niagara Falls; A. S. Scott, of Chicago; E. C. Scobell, of Rochester, N. Y., and L. M. Wallace, of Boston. Mr. Edwards expressed himself as believing that the report of the sub-committee on a tentative classification of accounts is superior to any forms so far promulgated by the public-service commissions in this country. Several gentlemen inquired how many members who were not operating under a public-service-commission law regulating accounting had not adopted the uniform system compiled by the N. E. L. A. and why. Mr. Scott said that the system could not be applied to hydroelectric and transmission business without several amplifications. It was hoped that the tentative classification which was submitted by a sub-committee at a later session would fulfil the requirements of that branch of the industry, however. Copies of the uniform system of accounting were distributed at the end of the session in order that suggestions or changes might be recommended before the system was submitted on the following day. Mr. Bowers, in closing the discussion, urged that the members adopt this uniform system before the public-service commissioners compelled them to adopt one less desirable.

ACCOUNTING SCHOOL FOR EMPLOYEES

In a paper by Mr. A. L. Holme a summary was given of the generally unsatisfactory conditions obtaining among the employees in the accounting departments of large central stations and an account was presented of the steps taken by the New York Edison Company to overcome these obstacles, in part at least, by the inauguration of an accounting school for its employees. This course was given on Wednesday evenings from 8 to 10 o'clock during the past winter season, and attendance was optional. Nine lectures on accounting theory and practice were given by an instructor from the New York University School of Commerce, Accounts and Finance; three written examinations were held, and six talks were given by company officials on the following topics: "Accounting Methods of the Company," "Relation of Accounting to the Company's Executives," "Work of the Contract and Inspection Departments," "Meters," "Purchasing and Supply Accounting," and "Customers' Accounts." The paper gave the three sets of examination questions used, as well as an outline of the accounting lectures by Mr. J. T. Madden, which were arranged under the following headings: "Bookkeeping," "Assets and Liabilities," "Assets," "Investments," "Current Assets," "Patents, Copyrights and Trade-Marks," "Funds," "Capital Liabilities," and "Interpretation of Balance Sheets."

While it is hard to measure the exact results of an innovation of this character, particularly in its early stages, Mr. Holme expressed the opinion that it had been a success. The replies to the first set of examination questions, he said, indicated that the course was needed even more than had been thought, and the improvement in the succeeding examinations seemed to show an advance. He said also that much apparent interest was shown in the subject of accounting outside of the course, which he thought to be a favorable sign. As to the attendance, out of a possible 600, 399 enrolled for the course; the largest attendance was 301 at the first lecture, and the smallest was 132 at the last lecture.

Discussion

Considerable interest was manifested in the discussion of this paper, in which the following participated: Messrs. F. L. Thornton, of Kansas City, Mo.; F. A. Birch, of Philadelphia; Herman Spoehrer, of St. Louis; R. W. Symes, of Detroit; J. C. Van Duyne, of Brooklyn, N. Y.; H. B. Skinner, of New York; J. H. Gulick, of Chicago; S. W. Ashe, of Harrison, N. J.; F. Heydecke, of Newark, N. J.; C. N. Ryan, of Wilmington, Del.; F. L. Riordan, of St. Louis, and H. M. Edwards, of New York. The discussion consisted mostly of questions relating to the success which the New York Edison Company has had with its accounting school. Members representing smaller cities were anxious to know how such an educational bureau could be conducted by smaller companies. Mr. Birch said that it is only when "friendly rivalry and competition" are incited that employees are willing to take advantage of an educational bureau. It was suggested and heartily supported that the employees be allowed to study during work hours and that certain prizes be offered for the best scholarship. Mr. Riordan believes that such a school should be conducted to develop the average employee rather than to weed out the "laggards." Another suggestion which is worthy of attention was that the employees be educated as to the company's policy.

PREPAID AND ACCRUED ACCOUNTS

One of the latest advances in scientific cost accounting for central stations is the keeping of prepaid and accrued accounts whereby the payments for insurance, taxes and extraordinary repairs are distributed over an extended period of time instead of being credited in a lump sum to the

month in which they are made. A paper by Mr. Franklyn Heydecke, Public Service Electric Company, Newark, N. J., contained a brief explanation of the method employed in keeping various classes of prepaid and accrued accounts and an outline of the advantages gained by so doing. The particular accounts which the author indicated as requiring this treatment were taxes, rentals and income on investment, and he showed clearly that without such methods the actual condition of the business could not be correctly given in the usual monthly statements. He indicated furthermore that these special accounting methods act as a safeguard against unexpected financial embarrassment since they are essentially neither more or less than an equitable distribution of a lump expense or income over the period in which it is incurred or earned.

Discussion

Subjects relating to the details of accounting were discussed by Messrs. H. M. Edwards, of New York; F. A. Birch, of Philadelphia; R. W. Symes, of Detroit; F. G. Speidel, of Louisville, Ky., and F. L. Riordan, of St. Louis. The main subject brought up was the accruing of taxes over the fiscal year. Mr. F. Heydecke said that when the fiscal year commences at any other time than Jan. 1 the taxes should be considered as prepaid. He also recommended the use of separate schedules for each class of tax.

Mechanical Aids to Office Routine Work

Mr. H. B. Lohmeyer, of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., presented a paper in which were described the more important machines at present available for saving time and labor in carrying on office routine work. In the past decade wonderful progress in the perfection of such devices has been made and there is hardly a part of office routine to which one or more of these devices has not been applied. Some of these machines have become so common as to rank with the telephone as necessities. Of this class are the typewriter, adding and listing machines and the slide rule. Among the less commonly used devices are the tabulating machine, the duplicating devices of various kinds, mail opener, addressing machine, counting machine and automatic cashier. Mr. Lohmeyer discussed each of these special devices and gave an outline of its development and of its field of usefulness in modern office procedure.

Discussion

Messrs. E. A. West, of Portland, Ore.; D. H. McDougall, of Toronto, Can.; C. N. Ryan, of Wilmington, Del.; F. L. Riordan, of St. Louis; F. L. Thornton, of Kansas City, Mo.; F. Heydecke, of Newark, N. J.; J. H. Gulick, of Chicago; H. M. Edwards, of New York; E. J. Bowers and several others took part in an animated discussion which arose over the system of accounting employed by one company. The applicability of automatic office machines to smaller offices was questioned by several, but it was generally conceded that large offices save considerable time and money by their use. It was recommended that the statistics showing the cost of accounting per customer be compiled in order that the advisability of installing mechanical office appliances might be studied.

Tentative Classification of Accounts

A scheme of balance-sheet and indicant accounts, together with a complete classification of operating revenue and operating expense accounts, was submitted by the subcommittee on tentative classification of construction and operating accounts, of which Mr. J. L. Bailey, of the Consolidated Gas, Electric Light & Power Company of Baltimore, was chairman. This report included a schedule embracing practically all of the general accounts of the larger companies either in items or group accounts. Realizing, however, that smaller companies do not require an elaborate array of indicant accounts, the committee recommended groups of accounting divisions that would meet the need of the smaller companies and could be enlarged upon as the occasion demanded. With respect to income accounts it was the suggestion of the committee that the least number of accounts used by the smaller companies should not fall below the eight main divisions of operation expense, and that, except in the case of the smallest companies, the revenue accounts as included in the report should not be neglected. No matter how small a company may be, it cannot afford to overlook the importance of segregating its income accounts so as to show operating expenses, so that a control of the outgo may be secured, and to indicate the revenue, in order to know that the thing sold is accounted for both as to charges and collections.

Discussion

As the classification of equipment and income accounts has been threshed out in discussions at previous conventions, Mr. H. M. Edwards, of the New York Edison Company, recommended that only items on general ledger and indicant accounts be discussed. Following his recommendation, each item was read and discussed before proceeding to the next.

Mr. Lohmeyer, of Baltimore, in reading the report suggested several additions to the classification. About eighty members were present at the session and a large majority of them took part in the discussion. Among those who spoke were Messrs. E. J. Allegaert, of Newark, N. J.; H. M. Edwards, of New York; E. J. Bowers, of Kansas City, Mo.; Herman Spoehrer, of St. Louis; L. M. Wallace, of Boston; J. H. Gulick, of Chicago; J. L. Bailey, of Baltimore; Brenton, of St. Louis; F. L. Thornton, of Kansas City, Mo.; E. D. Marr, of Colorado Springs, Col.; A. L. Holme, of New York, and C. E. Calder, of Wichita Falls, Tex.

As the classification of hydroelectric accounts was compiled several years ago and is therefore not up to date, Mr. Edwards made a motion, which was passed, to the effect that a sub-committee be appointed to report to the general accounts committee before Aug. 1 on the classification of accounts connected with that industry. Arguments were raised as to the nomenclature of certain accounts. Mr. Lohmeyer suggested that items falling under plant investment should be lumped under "fixed capital," in order to conform with the public service commissions' ruling. The suggestion did not meet with much approval. Mr. Brenton believed that accounts resulting from central-station companies' selling appliances and fixtures should be listed under promotion of business and not under non-operating revenue. Considerable discussion arose over the disposal of cash discounts. Some contended that it should be credited to cost of material, others said that it should be credited to supply expense account. The problem of levying the overhead charge of supply expense met with the same variety of disposals. The discussion was passed over, with the question still hanging fire whether the overhead charge on supplies should be cleared or carried on the operating accounts. The New York Public Service Commission gives the option of clearing the account or carrying it on the operating expense, but desires to be informed what disposal is made of it. Another item in the classification of accounts which aroused discussion was the classifying of bond interest paid to trustees. Mr. Allegaert believed that the provision made in the report necessitated too much bookkeeping. Mr. Williams, of Chicago, drew attention to the fact that no provision was made in the report for the classification of contract obligations under liability accounts. Quite a general opinion existed that no obligation existed which could be classed as a liability.

Mr. Edwards was called upon by Mr. Bowers, the vice-chairman, to tell of the results of an interview which he had with the public policy committee on the subject of depreciation. In one instance which came before the public policy committee it did not feel like setting a form of de-

preciation. Both the public policy committee and the committee on accounting were of the opinion that depreciation is a charge which should be set by each individual company. The estimation of such a reserve fund as well as the accrual thereof should be at the disposal of the company. Several public service commissions in appraising properties estimate the cost of reproducing the property and deduct a certain value for depreciation. The earning power of the corporation is limited by this appraised value, and Mr. Edwards said: "How will they earn money to reproduce the property if they can earn only on the reduced value thereof?" In place of a depreciation fund Mr. Edwards recommended that the property be kept up to 100 per cent value by repairs and the amount of such repairs charged to operating expenses. He did not favor the term depreciation; in fact, he said that depreciation is not an item of serious consequence in the electrical industry when considered alongside of obsolescence.

HANDLING FREIGHT BILLS

A scheme was proposed in a paper by Mr. A. S. Scott, of the Public Service Company of Northern Illinois, for eliminating the usual inefficiency and delay incidental to the handling of railway freight bills. The plan is one that has been tried and found successful by the above company and by the Illinois Northern Utilities Company. In making the change from the old system a letter was addressed to the several department heads giving notice of the new method to be employed in caring for this end of the business and an outline of procedure under the new régime. These instructions were explained in the paper. Receipted original freight bills on delivery to local superintendents are paid immediately by drafts, made payable to the railway company, and these bills attached to the duplicates of the drafts are sent to the purchasing or fuel department for approval and from there to the auditor. The system is arranged so that the company is protected from loss through cashing of irregular drafts, and the railway companies readily agreed to entertain claims for incorrect charges after the items had been paid. The plan results essentially in placing railroad freight on a "c. o. d." basis. Among the advantages claimed for it are the elimination of a lot of unnecessary clerical work with a corresponding reduction of expense, the securing of more prompt payments, and the avoidance of considerable friction between local superintendents and the railroad agents.

Discussion

Opening the discussion of Mr. Scott's paper, Mr. F. A. Birch, Philadelphia, Pa., testified to his own difficulties in getting freight bills in. Mr. F. Heydecke, Newark, N. J., told of the work of the National Freight Tariff Bureau which handles freight bills throughout the country, auditing them for a nominal charge of about 1 cent each. Provisions are made for rebating overcharges. Mr. E. C. Scobell, Rochester, N. Y., said that in his case the carting company renders the bill for freight charges with its carting charge. The Chicago company, said Mr. Scott, has one man devote his entire time to checking freight tariffs. Several district offices are located throughout the country, to which the draymen take their freight bills, having drafts made and thus avoiding delays on the part of the railroad company in forwarding bills. The company pays its freight bills before the goods themselves are delivered, and if overcharges are made claims are filed against the railroad company. This plan, said Mr. Scott, has proved quite satisfactory.

ACCOUNTING FOR DEPRECIATION

In prefacing his paper on accounting for replacement of plant retired from service Mr. Frank A. Birch, of the Philadelphia Electric Company, stated that since local conditions, the earning capacity of the plant and, in some cases, the supervision exercised by public service commissions must be taken into consideration, it is difficult to present a treatise on the subject which is possible of wide application. He therefore considers from an accounting viewpoint some of the things that should be done and from these observations makes applications to practice. The accounts should show the cost to the company of all properties. This should include the separate cost of each generating station, substation, line and all units of construction. The accounts of overhead and underground construction should be kept in such manner as will show at all times the complete cost of any particular line or portion thereof, so that upon retirement or replacement the amount to be charged to the depreciation reserve account may be readily determined. Accounts of a general nature should not be maintained in the general ledger unless subsidiary books are also kept which will show in detail the properties and lines included in such general accounts with individual costs of each. By charging against depreciation reserve account the cost of entire plants, lines and poles, or the cost of any item of construction retired, and charging directly into the property accounts the cost of plants or lines reconstructed, the accounting end of the proposition is kept clear and plain. The author considered depreciation in connection with the construction of a new plant or the installation of new equipment, and reviewed briefly the operations that are involved under the work-order system. In particular, he emphasized the fact that any scheme of accounting laid out should be consistently adhered to.

Discussion

Mr. F. L. Thornton, Kansas City, Mo., suggested that the difference between the salvage and actual value of the plant be credited to depreciation.

Mr. Hermann Spoehrer, St. Louis, Mo., told of the experiences of the Union Electric Light & Power Company in keeping a depreciation inventory.

Mr. A. L. Holme, New York, explained the use of separate accounts in charging up poles, lines and service runs. If salvage be credited to depreciation, in cases where a certain salvage is received f. o. b. the amount paid for freight will actually be lost. Instead of disposing of scrap metal to junk dealers, Mr. Holme proposed that companies classify this material and sell it as "clean metal." Similarly, lead can be melted up and made into pipe. In answer to a question by Mr. P. H. Palmer, Kokomo, Ind., Mr. Holme said that the New York practice is to charge replacement to depreciation, except where betterment has been involved.

Mr. F. L. Riordan, of St. Louis, Mo., said that under the job-order system disbursement sheets are earmarked to show to what expense account each should be charged. Mr. C. E. Brenton, St. Louis, said that the labor of removing and installing services is kept under a single account by the Union Electric Company, but not as a construction charge. By means of the unit system used, the cost of installing can be easily ascertained.

Mr. J. C. Van Duyne, Brooklyn, N. Y., described his company's practice in charging installation and removal costs to property account, later transferring the account when the customer is connected up for service.

Mr. L. M. Wallace, of Boston, described the practice of the Boston Edison company in charging all surplus apparatus, transformers, meters, etc., to stock accounts, later transferring them to plant account when put into service.

Mr. W. H. Winslow, Superior, Wis., described the use of large-scale maps to show work orders. The New Jersey Public Service Commission, according to Mr. F. Heydecke, Newark, N. J., requires that meters, transformers, etc., shall be charged to "floating stock."

Others who took part in the discussion of the paper were Messrs. A. S. Scott, Chicago, Ill.; F. L. Thornton, Kansas

City, Mo.; H. B. Lohmeyer, Baltimore, Md., and E. C. Scobell, Rochester, N. Y.

Statistical Exchange

A sample of the form report of the statistical exchange, together with a few words as to the reasons for this work, composed the report of the sub-committee under the chairmanship of Mr. Herman Spoehrer, of the Union Electric Light & Power Company, St. Louis. It was explained that, owing to the fact that the information obtained is such as is in constant demand and must be up to date and quickly available, it must be secured fresh each year. A statistical arrangement has not yet been perfected, but it is expected that one will be produced in the near future.

Standard Accounting Forms

The activity of the sub-committee on forms, of which Mr. C. L. Campbell, of the United Electric Light & Water Company, Waterbury, Conn., was chairman, was outlined in its report. This activity consisted in bringing up to date the work of the accounting committee in 1910, of compiling information on the various forms used in public-utility accounting. The new compilation was arranged according to the size of the cities served rather than by the nature of the form. The principal divisions made were general accounting, current bookkeeping, storeroom bookkeeping, contracts, new-business solicitors' reports, shop and storeroom reports, workmen's affairs, superintendents' and foremen's reports and printed matter. The practices of the companies investigated were shown to vary widely as to style, size, color, typing and the completeness of the blanks and forms used, and it was suggested that much would be gained by standardizing practice in these matters.

Relation Between Accounting and Operation

Mr. F. H. Patterson, of the Rochester Railway & Light Company, presented a paper on "The Relations of the Accounting Department to the Other Departments of the Company." The accounting in the central-station industry has developed into nearly perfect conditions, with scientific accuracy available in regard to practically every detail of the business. This the author largely ascribed to the work of the Public Service Commission of New York and other public utility commissions in promulgating scientific classifications of accounts. The annual reports filed with the commissions, which deal so exhaustively with the company's affairs, are most exacting to compile but nevertheless invaluable.

The author strongly emphasized the necessity of having the auditor systematize the various departmental records, because he is by training properly fitted for such work and his comprehensive knowledge of the business enables him to outline the least wasteful system. The general knowledge of the business thus obtained is, if properly used, of the greatest benefit to the company. On the other hand, no officer in the service is in a position to work greater harm to the directors and stockholders than the auditor. Matters which affect the very life of the company are in his safekeeping and, through ignorance, fraud or negligence, the reputation of the directors may be jeopardized or their financial ruin brought about. The directors, acting on the basis of the statements of the auditor, may declare a dividend when really no profit exists and where this action would be most inimical to the welfare of the business.

The policy adopted by some of the large public service companies whereby the auditor receives his appointment from the board of directors and is responsible to them only was considered a praiseworthy one. A number of points were brought out by the author showing the many pitfalls of an auditor in the ordinary course of his work, in order to show how essential it is that only men of the broadest experience and integrity be appointed to such positions.

The author further discussed the importance of submitting carefully prepared statements periodically to the general manager, directors, heads of departments and superintendents, so as to enable the executive officers to analyze cost and expenditures and make suitable changes where it may be found desirable in order to improve the economy of operation.

Discussion

In commenting on Mr. Patterson's paper, Mr. A. L. Holme, New York, declared that the author had "hit the nail on the head" so squarely that he thought no discussion was necessary.

Mr. J. C. Van Duyne, Brooklyn, N. Y., urged that the auditor be made directly responsible to the board of directors of the company instead of to the general manager. Messrs. F. L. Thornton, St. Louis, Mo., and E. E. Corkin, Peoria, Ill., also spoke briefly.

Handling of Bond Coupons

Some interesting data were given in a paper by Mr. W. J. Kehl, of the Virginia Railway & Power Company, Richmond, Va., on the subject of bond coupons, what they represent and how they are used. Explanation was given of the method of securing first-mortgage bonds by a deed of trust and also of the significance of the attached coupons, these being simply printed orders of the company to pay to the bearer at a specified time and place the semi-annual interest accruing on the bond. The coupons are numbered consecutively and bear, in addition to this number and that of the bond, the date for collecting interest and the name of the agency through which interest is to be paid. Upon payment of the interest the coupon is canceled by perforation. The author touched upon the accounting methods involved in keeping track of coupon payments and explained how record is kept of matured coupons unpaid. The preservation of canceled coupons, awaiting the maturity of the bond and final payment of both principal and interest, was stated to have become a very annoying problem through the increase in extent and size of bond issues. It was suggested that canceled coupons be periodically burned and a certificate of cremation issued to cover the transaction and represent that block of coupons in the final accounting.

Discussion

Among those who discussed the paper were Messrs. W. H. Winslow, of Superior, Wis.; E. C. Scobell, of Rochester, N. Y.; A. S. Scott, of Chicago; N. McDougall, of Toronto, and L. M. Wallace, of Boston. To avoid using a bulky book for bond coupons, Mr. Winslow said he uses a book with heavy manila leaves on which are numbers corresponding to the bonds and coupons. As the coupons are turned in they are pasted in this book, overlapping each other but showing the bond and coupon number. Mr. Scott advised keeping a record of the history of mortgages and disposal of bonds.

Meters and Measurements

Report on Meters

Mr. W. H. Fellows, of the Potomac Electric Power Company of Washington, D. C., chairman of the committee on meters, presented a forty-seven-page report covering the work of the committee for the past year. The code which the meter committees of the N. E. L. A. and of the Association of Edison Illuminating Companies have been formulating since early in the year 1910 has been revised and was presented in its latest form in this report.

The committee commended the "Electrical Meterman's Handbook," which was published last year, as a book which no public utility maintaining a meter department should be without. Further information has been gathered for addi-

tion to the handbook when at some future time it shall be deemed advisable to revise it. Last year the committee on meters had before it for consideration a standard form of dial face for watt-hour meters and the present committee has now adopted a form. The form of dial face adopted has been approved by the N. E. L. A. committee on meters and the meter committee of the Association of Edison Illuminating Companies. Different manufacturers also have been provided with a copy of the dial face and are assuring their co-operation.

Discussion

Mr. John C. Parker, Rochester (N. Y.) Railway & Light Company, spoke at some length upon the absence of adequate consideration of demand meters in the report. He urged that improvements of from 1 to 4 per cent in the accuracy of watt-hour meters are of less importance than corresponding betterments in demand instruments, which easily vary the consumer's rate by from 10 to 20 per cent. An instrument is needed which will give the hour-to-hour demand, permitting satisfactory interpolation when disputes arise and not requiring a large amount of clerical work in its use. An instrument of the contact-making type is objectionable on account of the tendency toward interrupted or inaccurate readings in the course of the year, some 16,000 makes and breaks being required in equipment giving half-hourly readings.

Mr. F. G. Vaughen, General Electric Company, Schenectady, N. Y., said that the committee's work is helpful to the manufacturers as facilitating standardization. He commended the specifications covering meter registering dials issued in the report and concurred in the desirability of standardizing connections. Closing, he touched upon the difficulties inherent in the design of an entirely satisfactory demand meter.

Mr. C. W. Wilder, Public Service Commission, First District, New York, cited the benefits of co-operation between the commission and the central-station companies as observed in the frank discussion of meter problems at hearings.

Units and Terminology of Power Measurements

Several of the power measurement units in use in this country and abroad were noted in the report of the committee on measurements, of which Dr. A. E. Kennelly, Harvard University, was chairman. There was also given a record of the recent action of the national engineering societies with regard to the watt. The committee favored the adoption of the myriawatt, about which there has been considerable debate during the past year. The advantage pre-eminently associated with such a step was held to be that of a unified system of measuring both the input and the output of steam engine-generator sets, making the important item of efficiency more readily apparent. The use of the term "kelvin," to displace the established kilowatt-hour, was opposed on the ground of ambiguity and because Lord Kelvin's name is being proposed for an important electrostatic unit.

Discussion

In the absence of Chairman Kennelly the report was presented by Dr. C. P. Steinmetz. The latter commented briefly on the report, pointing out that it is largely a compilation of information on recently proposed units, without any specific recommendations. Dr. Steinmetz deprecated the addition of units of a hybrid character to the nomenclature of the electrical industry, contending that the existing supply appears adequate for present needs. The proposed "myriawatt" for boiler rating is a makeshift unit and one might as well use the kilowatt or the megawatt. Even the adoption of the term "kelvin" for the kilowatt-hour has not found large acceptance because it is a mixture of units of different characteristics and is not an absolute unit on account of the hour factor.

Exhibit by Meter Committee

The exhibition by the meter committee, of which Mr. W. H. Fellows, of Washington, D. C., was chairman, contained a complete line of service meters of six different makes and a fine display 24 ft. long and 2 ft. wide of testing instruments and equipment for meter maintenance. A typical complete house-meter installation, protected against tampering and equipped with testing jacks as standardized by the Rochester (N. Y.) Railway & Light Company, was shown, with corresponding apparatus from the Philadelphia Electric Company and the New York Edison Company. Thirty different meters were displayed, including curve-drawing, printing and integrating instruments for a variety of purposes, special emphasis being laid upon equipment for the analysis of conditions in large industrial installations. The array of testing apparatus included a power-factor adjuster for laboratory service and a full line of the best American and European standard instruments for meter calibration and extra precise measurements. Adjustable series transformer equipment, portable loads, bridges, resistance boxes and other indicating and adjustable apparatus of the grade employed by the United States Bureau of Standards were shown.

Miscellaneous Subjects

Central-Station Insurance

Mr. W. H. Blood, Jr., of the Stone & Webster Engineering Corporation, Boston, the insurance expert of the National Electric Light Association, reported that during the year the industry has been comparatively free from annoying litigation with insurance companies. This was partly due to better construction work by the lighting companies and also to the insurance companies' better realization of the importance and solidarity of the association. Reductions in rates have been brought about by constant agitation and also because of the improved fire-loss records which the insurance companies are getting from the lighting companies.

The changes in the National Electric Code voted at the March meeting were briefly reviewed. A recommendation was made that the member companies should employ inspection bureaus to look over the properties of the lighting companies. Mr. Blood also expressed his eagerness to co-operate with member companies in the preparation and defence of lawsuits based on alleged negligence in wiring and of suits brought because of serious or fatal accidents.

Chairman Lloyd on Commercial Section Work

In his address, at the first session of the Commercial Section, Chairman Edward W. Lloyd gave in outline a history of the work of the section during the year. As a result of the plan of issuing literature sold to member companies the commercial section is to-day on a fairly sound financial basis. The commercial papers at this year's convention represent very generally the trend of progress in connection with the commercial side of the electric-service business. The chairman referred to the "Electrical Salesman's Handbook" and said that it was the intention to broaden the scope of the publication by including all subjects of interest to electrical salesmen. The work of the committees on "Electricity on the Farm" and the wiring of existing buildings was commented upon. The latter committee has before it a problem difficult of solution in some localities and there is no subject that should receive greater consideration at the hands of electric-service companies, manufacturers, dealers and contractors. In relation to off-peak business, the subject of using electricity for refrigeration was considered. The load factor of this class of business is 50 per cent or greater, averaging 75 per cent for the months from

April to October. During the year there have been added to the executive committee of the Commercial Section representatives of the national associations of electrical contractors and electrical supply jobbers.

Commercial Section, Finances and Membership

Mr. T. I. Jones, Brooklyn, N. Y., chairman of the finance committee, reported total revenues of $5,241 received during the past year, divided between dues and receipts from sale of publications. In all, $4,755 was expended, leaving with the surplus already on hand a balance of $502.87.

Mr. J. F. Becker, New York, chairman of the membership committee, reported a present enrolment of 1222 active members. Since last year 482 new members have been secured for the section, although 173 others were lost through resignation. Prospective lists of 2000 names are now being circularized, and a campaign is being waged to enrol members from among some 1000 applicants for the commercial session papers of the Seattle meeting. A scheme of organization with state captains is also to be attempted in making a more concentrated membership campaign during the coming year.

Question Box

The report made by Mr. S. A. Sewall, assistant to the secretary, on the Question Box dealt with the routine work involved in the handling, answering and printing of the questions received. By appealing to member companies to appoint a correspondent for their company who would see that questions were properly answered, 300 correspondents in as many different companies have been secured as regular contributors to the Question Box. Mr. Sewall believes that the Question Box should be devoted more and more to the problems confronting the smaller companies. During the year 300 new questions were asked, and to these over 1300 answers have been printed.

Oil-Pressure Bearings

A paper describing a new type of thrust bearing was presented by Mr. Albert Kingsbury, consulting engineer, Pittsburgh, Pa. The design of this bearing is based upon the principles established by Prof. Osborn Reynolds as a result of experiments by Beauchamp Tower. According to these theories, which are well borne out by experiments, there is practically no wear on a well-fitted cylindrical journal flooded with oil. The total friction is nearly independent of the load and the mean coefficient of friction is very low, in some cases not exceeding 0.001. It was further found that there was oil between the shaft and the brass under pressure, forming a wedge which completely separated the surfaces and reduced the friction to that within the oil itself. This wedge is thickest toward the side where the oil enters with the shaft in its rotation and thinnest toward the leaving side. The oil because of its adhesion to the shaft and because of its viscosity is dragged into the wedge-shaped space by the rotating shaft, and this action sets up the pressure in the oil, which in turn supports the load on the brass.

The mechanical details of this type of bearing are described elsewhere in this issue.

Discussion

Mr. J. C. Parker, Rochester, N. Y., commended the work of Professor Allen in hydraulic efficiency testing. He emphasized the rapid decrease in efficiency possible in hydraulic plants after long service. On a 10,000-hp unit this involves enough waste in idle investment to justify thorough testing even at considerable expense. Such tests at Rochester in the past year have led to plans for entirely rebuilding some of the company's hydraulic equipment to secure greater efficiency. He urged that every hydroelectric plant be equipped with a Pitot tube or a Venturi contraction in the pipe line, enabling the input of water to be tested properly at regular intervals. The use of a weir for operating tests is undesirable on account of the variations introduced by the choice of formulas. The speaker favored electrical measurements of output in place of brake tests, as the operating man's chief interest is the over-all efficiency of the unit, and as a practical matter the efficiency of electric generators is so high that the error introduced by losses is within the limits of accurate hydraulic measurement. Mr. D. B. Rushmore spoke briefly on the depreciation of blades through oxidation.

The Life Hazard in Electrical Practice

The United States Bureau of Standards will shortly begin an investigation of the subject of "life hazard in electrical practice." The general plan, as explained in a paper by Dr. E. B. Rosa, will be that of first securing the advice and co-operation of those best prepared to give valuable assistance and counsel, and then, after gathering together a large amount of information and experience obtained from operating men, manufacturers and others, a comprehensive report will be prepared. Sets of rules will also be formulated for the guidance of managers of operating and constructing companies, detailing approved practice in electrical construction for safeguarding life. It is also hoped to formulate rules in co-operation with public-service commissions in such form that these rules can be adopted by the commissioners or by city authorities, thus insuring, as far as possible, that electrical companies shall conform to the best practice for safeguarding life. Not only is it the duty of electrical companies to do all they can to reduce the life hazard in electrical work, but it will be to their material advantage to do so. Legislation soon will compel unwilling observance of strict and possibly drastic rules, unless voluntary action forestalls such need and renders the observance of reasonable and wisely drawn requirements free from embarrassment. And if there are to be rules or requirements, it is far better that they be drawn up after a thorough and impartial investigation, with the co-operation of those most experienced and most interested, than that they should be formulated independently by a large number of legislative bodies, each acting on different advice and experience and all together causing a great confusion of requirements.

The study is being taken up in the spirit of investigation, appealing both to experiment and experience, and the Bureau of Standards, said Dr. Rosa, invites the co-operation of both the N. E. L. A. and its individual members in planning and carrying out the work.

Exhibits by Class D Members

The exhibition made by Class D members of the National Electric Light Association in connection with the convention was very creditable considering the great handicaps encountered in transforming a low basement into an exhibition hall. With a ceiling varying from 8 ft. to 9 ft. in height and with about sixty columns cumbering the floor space, the outlook was not inviting. However, a certain number of the columns were selected as a basis for a semicircular court and special treatment in the way of latticework and pergolas was applied. The other columns were decorated with mirrors, as was also the entire background of the exhibition hall, latticework and indirect lighting of the signs in the latter case aiding materially in deceiving the eye as to the exact height of the room. White and French gray were the dominating colors, with rustic green signs for exhibitors in the center spaces. Owing to the lowness of the ceiling every effort was made to prevent glare, and to that end the 500 or more 25-watt tungsten lamps employed to supplement the regular building lamps were shaded with art glassware. Space was provided for

sixty-eight booths, but many exhibitors occupied more than one booth. A short description of the exhibits follows:

ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio.—Series alternating-current flame-arc lamps and transformers, incandescent lamps and reflectors, electric horns. Representatives: A. J. Selzer, V. N. Marker, C. W. Beach, R. H. Green.

AMERICAN DISTRICT STEAM COMPANY, North Tonawanda, N. Y.—Models of steam-heating fittings and meters, and district-heating literature. Representatives: W. H. Wells, C. R. Bishop, H. C. Kimbrough, B. T. Gifford, A. E. Duram, W. J. Kline, C. A. Gillham, J. A. Bendure.

AMERICAN IRONING MACHINE COMPANY, Chicago, Ill.—Electric ironing machines. Representatives: H. G. Grosse, G. A. Renner, J. L. Mayer.

A. & W. ELECTRIC SIGN COMPANY, Cleveland, Ohio.—Interchangeable electric signs and monogram letter units.

BELL ELECTRIC MOTOR COMPANY, Garwood, N. J.—Alternating-current, single-phase and compensated polyphase motors. Representatives: A. C. Bell, T. R. Bell, A. W. Eckhoff.

BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill.—Industrial fixtures and lighting specialties, including plug clusters and switch-controlling current taps. Representatives: R. B. Benjamin, W. D. Steele, H. E. Watson, A. N. Fox, B. G. Kodjbanoff, F. H. Poss, G. B. Weber, A. E. Lubeck, M. F. Steel, O. L. Johnson.

CENTURY ELECTRIC COMPANY, St. Louis, Mo.—Single-phase and split-phase motors and alternating-current fans. Representatives: R. J. Russell, H. A. Porter, E. Kumbo.

CHICAGO FUSE MANUFACTURING COMPANY, Chicago, Ill.—Inclosed fuses, conduit fittings and switch and outlet boxes. Representatives: W. E. Finley, A. S. Merrill, W. W. Merrill.

CONLON-SIMPLEX MACHINE COMPANY, Chicago, Ill.—Electric washing machines. Representatives: W. J. Conlon, W. T. Haynie.

CO-OPERATIVE ADVERTISING SERVICE FOR CENTRAL STATIONS, Chicago, Ill.—Photographs, proofs and advertising specimens. Representatives: G. C. Tremaine, R. A. Pick.

COOPER HEWITT ELECTRIC COMPANY, New York, N. Y.—Mercury-vapor and quartz-tube lamps, and battery-charging rectifier. Representatives: I. B. Carey, G. C. Keech.

DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind.—Transformers, and house-type, portable and switchboard watt-hour meters. Representatives: Thomas Duncan, A. G. Lucas, H. O. Hall, W. H. Sinks.

DUPLEX METALS COMPANY, Chester, Pa.—Copper-clad bare and weather-proof wire, rods, choke coils, etc. Representatives: S. C. Munoz, T. K. Stevenson, W. D. Ball, W. T. Kyle, W. H. Lipscomb, J. M. Rodger, B. F. Cameron, C. B. Semple, L. M. Garden.

ECONOMICAL ELECTRIC LAMP WORKS OF GENERAL ELECTRIC COMPANY, New York, N. Y.—Turn-down electric lamps. Representatives: M. Lobenthal, L. Lobenthal.

ECONOMY FUSE & MANUFACTURING COMPANY, Chicago, Ill.—Inclosed fuses, renewal links and service tests. Representatives: A. L. Eustice, J. B. Griffith, A. E. Tregenza.

EDISON STORAGE BATTERY COMPANY, Orange, N. J.—Nickel-iron storage batteries, plates, parts, etc. Representatives: W. G. Bee, C. B. Frayer, W. C. Andrews.

ELECTRIC APPLIANCE COMPANY, Chicago, Ill.—Regulators and high-tension protective apparatus. Representatives: W. W. Low, P. R. Boole, F. J. Alderson, H. Fedde.

ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa.—Lightning arresters, insulators and line specialties. Representatives: J. W. Porter, M. A. Berg, O. Mueller, T. H. Henkle, H. H. Johnson.

ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa.—Storage batteries, plates and parts; factory illustrations and publications. Representatives: G. H. Atkins, T. Milton, T. Cressey, J. Rosholt, E. Kelly, P. Rebel, D. Parker, R. I. Baird, C. Blizard.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, New York, N. Y.—Samples of advertising copy, proofs, etc. Representatives: Harvey Robinson, F. W. Smith, H. E. Niesz, W. J. McDowell.

ELECTRICAL REVIEW & WESTERN ELECTRICIAN, Chicago, Ill.—Electrical magazines. Representatives: C. W. Price, A. A. Gray, H. S. Tuthill, E. E. Wood, J. B. McCarthy, C. W. Forbrich, F. R. Schalck, M. G. Lloyd, F. H. Bernhard, H. Ehrlich, J. E. Latta.

ELECTRICAL WORLD, New York, N. Y.—Electrical and engineering magazines. Representatives: James H. McGraw, G. W. Elliott, D. T. Pierce, J. A. Kucera, C. T. Walker, Sam A. Hobson, F. E. Watts, H. T. Matthew, W. H. Onken, Jr., W. E. Keily, O. H. Caldwell, H. S. Knowlton, A. M. Perry.

EUREKA VACUUM CLEANER COMPANY, Detroit, Mich.—Electric vacuum cleaners. Representatives: F. Wardell, R. Field, O. B. Schubert.

FEDERAL SIGN SYSTEM, ELECTRIC, Chicago, Ill.—Electric signs, miniature signs, fittings, supplies, shades, units, reflectors, fixtures, vacuum cleaners, washing machine, power table for kitchen, indirect lighting, meters, transformers, meter-protective devices and house pumps. Representatives: A. R. Gibbons, A. R. Dean, E. E. Rines, R. J. Wherry, W. J. Devine, J. E. McClernon, F. E. Brown.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.—Multirecorder; incandescent, luminous and flame-arc lamps, ozonators, lightning arresters, electric ovens and ranges, instruments, small motors, regulators, relays, transformers, reflectors and shades. Representatives: A. W. Burchard, E. W. Rice, Jr., D. B. Rushmore, E. E. F. Creighton, N. R. Birge, R. H. Carlton, D. R. Bullen, Frank H. Gale, G. F. Morrison, C. B. Burleigh, H. B. Rogers, H. C. Ward, C. A. S. Howlett, W. H. McLaren, E. E. Gilbert, C. W. Stone, H. R. Summerhayes, E. B. Merriam, F. G. Vaughen, C. P. Steinmetz, E. P. Edwards, R. E. Woolley, A. K. Baylor, R. T. Wagner, C. R. Croninger, R. A. Swain, J. C. Kearns, D. S. Martin, W. M. Stearns, S. H. Blake, A. D. Page, H. Schroeder, R. B. Parker, G. C. Osborn, F. W. Sanford, J. W. Howell, G. N. Chamberlain, E. L. Barr, M. Tattersfield, G. L. Thompson, E. H. Ginn, T. W. Moore, P. Worth, T. J. Ryan, T. E. Bibbins, H. M. Hall, J. A. Cranston, William Hand, J. H. Livsey.

GENERAL VEHICLE COMPANY, Long Island City, N. Y.—Electric truck chassis. Representatives: P. D. Wagoner, E. E. Witherby, W. J. McDowell, E. W. Curtis, Jr., H. W. Hillman, T. W. Barnes, J. S. Gorham.

G. & W. ELECTRIC SPECIALTY COMPANY, Chicago, Ill.—Cable terminals, junction boxes, high-tension fuses, disconnecting switches and high-tension devices. Representatives: G. P. Edmonds, J. M. Hundley.

HOTPOINT ELECTRIC HEATING COMPANY, Ontario, Cal.—Electric ovens, stoves, irons, toasters, percolators, grills, chafing dishes, foot warmers, radiators and immersion water heaters. Representatives: J. R. Richardson, M. J. Wolf, H. A. Ross, W. A. Richards, E. W. Donoho.

HUBBARD & COMPANY, Pittsburgh, Pa.—Insulator brackets, stamped steel poles and cross-arms, and high-tension line specialties. Representatives: C. L. Peirce, Jr., O. W. Youngquist, W. R. Pounder.

HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill.—Electric ranges, stoves and radiators. Representatives: G. A. Hughes, A. F. Vaughan, G. J. Brucker, A. Smith, C. E. Marsh.

HURLEY MACHINE COMPANY, Chicago, Ill.—Washing machines and vacuum cleaners. Representatives: N. C. Hur-

ley, T. J. Casey, R. C. Knopke, O. L. Romme, W. A. Murfey.

Innovation Electric Company, New York, N. Y.—Motor-driven suction cleaners. Representatives: F. N. Davidson, L. Bourgette.

H. W. Johns-Manville Company, New York, N. Y.—Electric-driven refrigerating machines, thermal and electrical insulations, fuses, conduit, boxes and fittings, lamps and reflectors. Representatives: J. W. Perry, H. M. Frantz, H. W. Frantz, G. A. Saylor, W. E. Rapp, R. R. Braggins, R. C. Cole, R. F. Massa, R. J. Stewart.

Life-Saving Devices Company, Chicago, Ill.— Resuscitation apparatus. Representatives: F. T. Fowler, J. N. Giblin, F. T. Fowler, Jr.

W. N. Matthews & Brother, St. Louis, Mo.—Fuse switches, line material, cable clamps, test devices and pole-height estimators. Representatives: W. N. Matthews, C. L. Matthews, W. Bischoff, J. L. Fay, V. L. Crawford.

Meter Exhibit, N. E. L. A.—Meters and meter accessories.

Metropolitan Engineering Company, New York, N. Y. —Meter and central-station protective devices, and electric bath cabinet. Representatives: T. E. Murray, J. E. McClernon, F. E. Brown.

Minerallac Electric Company, Chicago, Ill.—Maximum-demand devices, printometers, maxicators and graphometers. Representatives: H. S. Sines, C. I. Hall, J. Van Buskirk, A. J. Olson.

Moloney Electric Company, St. Louis, Mo.—Transformers. Representatives: T. O. Moloney, J. J. Mullen, L. H. Keller, J. R. Dean.

National Quality Lamp Division of General Electric Company, Cleveland, Ohio.—Standard and miniature "Mazda" lamps, examples of illumination and moving and mechanically operated display devices. Representatives: J. R. Crouse, S. E. Doane, W. M. Skiff, G. S. Merrill, N. H. Boynton, E. J. Edwards, C. W. Bender, Ward Harrison, R. W. Shenton, M. D. Cooper, F. J. Blaschke, R. W. Tavey.

National X-Ray Reflector Company, Chicago, Ill.—Indirect-lighting and direct-lighting reflectors and portable and ceiling units. Representatives: A. D. Curtis, H. B. Wheeler, T. H. Aldrich, E. L. Haines, E. E. McKinnie, W. R. Moulton, J. N. Labelle.

Oshkosh Manufacturing Company, Oshkosh, Wis.—Construction tools, pike poles, shovels, climbers, reels, insulator pins and pole anchors. Representatives: J. W. Whooley, R. L. Thayer.

Otis Elevator Company, New York, N. Y.—Elevators. Representatives: R. W. Charles, H. E. Turner, R. H. A. Carter, E. W. Eaton, E. A. Henderson, E. R. Wilson, H. S. Snead.

Philadelphia Electric & Manufacturing Company, Philadelphia, Pa.—Lighting standards, hangers and fittings. Representatives: R. H. Manwaring, W. O. Dale.

Pittsburgh Transformer Company, Pittsburgh, Pa.—Exhibits and photographs of heavy-duty mill-type transformers, series street-lighting system, outdoor high-tension transformers, etc. Representatives: R. V. Bingay, H. G. Steele, P. H. Butler.

Popular Electricity Magazine, Chicago, Ill.—Electrical magazine. Representatives: W. Harvey, Jr., J. A. Harney, H. W. Young, G. T. Hadley, B. E. Blanchard, W. J. Wheeler, B. W. Cook.

John A. Roebling's Sons Company, New York, N. Y.—Wires, cables and fittings. Representatives: A. B. Conover, W. J. Slingluff, E. H. Christoph, A. V. Errickson.

Sangamo Electric Company, Springfield, Ill.—Instruments and meters, ampere-hour meters, circuit-breakers and distant-operating dial mechanism. Representatives: R. C. Lanphier, H. W. Young, J. H. Hodde, A. E. Pickard.

Simplex Electric Heating Company, Cambridge, Mass. —Heating devices, irons, stoves, ranges, percolators, hot plates, heating pads, radiators, ovens, etc. Representatives: J. I. Ayer, E. R. Jacobs, D. Rollins, J. H. Johnson, F. L. McKenna.

Southern Exchange Company, New York, N. Y.—Poles and cross-arms. Representative: E. G. Chamberlain.

Standard Underground Cable Company, Pittsburgh, Pa.—Wires, cables, junction boxes, terminals, insulating compound and cable-splicing sleeves. Representatives: G. L. Wiley, J. R. Wiley, E. J. Pietzcker, E. F. Norton, R. E. Green, J. H. Lytle, W. Hauck, R. B. Wilcox.

Thompson Electric Company, Cleveland, Ohio.—Cut-out hangers for arc and incandescent lamps. Representative: A. J. Thompson.

Tungstolier Works of General Electric Company, Conneaut, Ohio.—Household fixtures and industrial lighting units. Representatives: G. C. Webster, F. C. Maxheimer, A. B. Wilson, C. F. Reel, J. B. Higgins, W. G. MacMartin.

Valentine-Clark Company, Minneapolis, Minn.—Butt-treated poles. Representatives: L. A. Furlong, E. L. Clark.

Wagner Electric Manufacturing Company, St. Louis, Mo.—Electrical apparatus and instruments, unity-power-factor motors, converters and rectifiers. Representatives: W. A. Layman, J. Mustard, E. W. Goldschmidt, E. H. Cheney, F. Johnson, A. J. Meyers, J. A. Gelzer, P. L. Lewis, H. E. Griffin, E. M. Webber, W. R. Patton, R. D. Lillibridge.

Western Electric Company, New York, N. Y.—Heating appliances, vacuum cleaners, fans, incandescent lamps, fixtures, shades, fuses, insulators, line supplies, model high-tension pole line, interphones, loud-speaking telephones and special telephone equipment. Representatives: H. R. King, R. A. Griffin, A. G. Kingman, H. L. Grant, J. F. Sweeny, W. B. Pierce, W. Mueller, J. R. Kearney.

Western Water Supplies Company, Kansas City, Mo.—Electric sterilizers and electric sterilized coolers. Representatives: P. Thompson, J. H. Thompson.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—Heating apparatus for domestic and industrial use, meters, fans and small motors, ozonizers, insulating material and solder, mercury-arc and mechanical rectifiers, circuit-breakers, lightning arresters, transformers and spark-gap. Representatives: Guy E. Tripp, L. A. Osborn, S. L. Nicholson, G. B. Griffin, C. S. Cook, H. W. Cope, Robb Mackie, C. E. Allen, A. A. Brown, Wm. Clegg, Jr., J. McA. Duncan, J. J. Gibson, C. E. Heise, J. S. Tritle, K. E. Van Kuran, G. S. Vail, J. A. Brett, T. E. Collins, E. P. Dillon, G. C. Ewing, S. A. Fletcher, A. D. Fishel, E. O. Kirkpatrick, S. D. Levings, T. A. McDowell, A. H. McIntyre, J. C. McQuiston, H. W. Beaumont, J. N. Mahoney, Paul MacGahan, H. C. Owens, T. J. Pace, M. C. Rypinski, E. G. Reed, C. G. Schluederberg, W. A. Thomas, E. A. Thornwell, J. M. Tomb, H. H. Van Staagen, D. E. Drake, S. E. Chase, A. E. Allen.

Westinghouse Lamp Company, Bloomfield, N. J.—Electric incandescent lamps. —Representatives: Walter Carey, T. G. Whaling, B. F. Fisher.

Westinghouse Machine Company, Pittsburgh, Pa.—Turbine-driven centrifugal boiler-feed pump. Representative: E. H. Sniffin.

Weston Electrical Instrument Company, Newark, N. J.—Alternating-current and direct-current indicating instruments, laboratory and miniature precision instruments, instrument transformers, etc. Representatives: G. P. Frey, P. Westburg, R. Johnson.

Wilkinson Company, Chicago, Ill.—Portable lamps, art-glass shades, etc. Representatives: I. A. Jones, R. A. Soukup, O. C. Helm, O. Hochberg.

Philadelphia, Pa. clines and vacuum cleaners. Representatives: N. C. Hur-

Electric Service in Chicago Suburbs

High system load-factors and operating economies achieved by the Public Service Company of Northern Illinois through diversified demands of its customers

BETWEEN the extreme outposts of its system, 150 miles apart on the borders of the important industrial, suburban and agricultural region surrounding Chicago, the central-station energy furnished by the Public Service Company of Northern Illinois finds numerous and remarkably varied applications in supplying the electrical needs of 46,000 customers in 150 communities whose combined population is half a million.

As a natural consequence of the diversity of such interconnected operation the system load-factors achieved approach 70 per cent, the principal steam station operating, for example, at 65 per cent and higher, while full-load conditions are imposed twenty-four hours a day on the water-power plants which produce about a quarter of the system output. The large industrial and railway loads carried are chiefly responsible for the peak maximums, which now occur during daylight hours. Special attention has also been devoted to acquiring such characteristic long-hour loads as town water-works, sand and gravel pits, etc. Another interesting aspect of the company's activity has been the distribution of electric service to farms for lighting and power purposes, thus according to its rural customers the same conveniences and rates enjoyed by their cousins in town.

Generating Plants and Transmission Systems

The present system of the Public Service Company of Northern Illinois represents the combination of five utility corporations which formerly operated in their respective territories as follows: The North Shore Electric Company; the Chicago Suburban Light & Power Company, of Oak Park; the Economy Light & Power Company, of Joliet; the Illinois Valley Gas & Electric Company, of Streator, and the Kankakee Gas & Electric Company. The North Shore Electric Company, the nucleus of the system, has been operated for many years under the present management, supplying service to the suburban and industrial regions fringing upon the city limits. The outer borders of the North Shore company's activities at that time were practically the limits of Cook County, including in addition the Lake County region north to the Wisconsin line.

Up to the present, as shown by the map, the northern and southern transmission systems of the Public Service Company still remain to be united by the completion of the projected link between Park Ridge and Maywood, so that in matters of physical operation the two sets of lines are yet operated as distinct systems. Actual electrical connection is, however, indirectly established between the two systems by the tie lines connecting the Public Service Company's plants and substations with the Commonwealth Edison Company's system, thus making a unit of the entire interconnected central-station network in the Chicago district.

TABLE I—GENERATING STATIONS OF PUBLIC SERVICE COMPANY

Station	Power	Rating, Kw.
Blue Island	Steam	22,000
Waukegan	Steam	15,000
Joliet	Water	3,500
Joliet	Steam	1,500
Maywood	Steam	2,250
Oak Park	Steam	2,200
Streator	Steam	1,500
Kankakee	Steam	600
Kankakee	Water	600
Evanston	Steam	600
Lacon	Steam	500
Wilmington	Water	100
Algonquin	Water	60

Fleven generating stations scattered over the Public Service Company's system produce the output which is distributed by thirty or more substations. These generating plants, with their ratings, are given in Table I.

In addition to the foregoing prime-mover plants, the 2000-kw substation at Evanston is supplied with energy transmitted from the Northwest and Fisk Street stations of the Commonwealth Edison Company. There are also tie lines between the Edison company's Quarry Street station and the Blue Island plant of the Public Service Corporation.

The stations at Evanston, Waukegan and Oak Park furnish hot-water district-

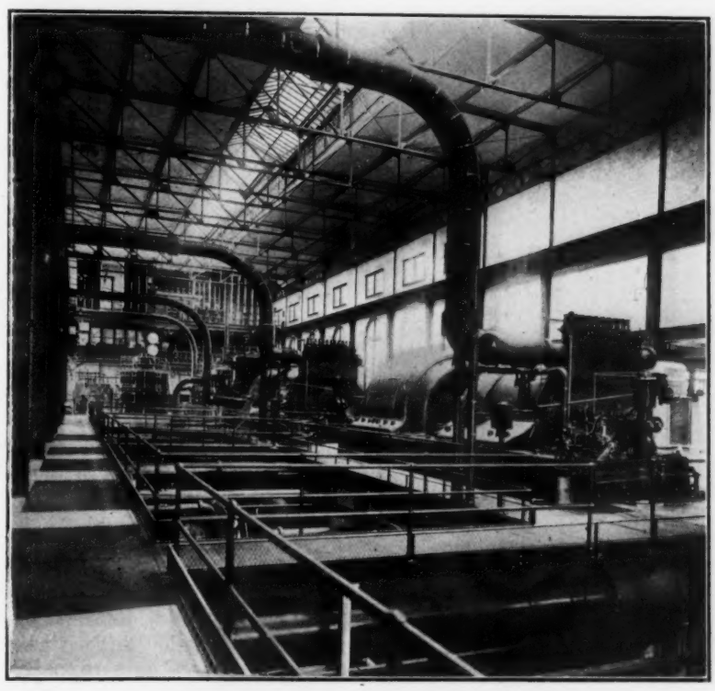


FIG. 1—INTERIOR OF BLUE ISLAND STATION

heating service; those at Streator and Pontiac heat with exhaust steam.

Blue Island Turbine Station

The principal generating plant of the system is located at Blue Island, Ill., on the bank of the Little Calumet River.

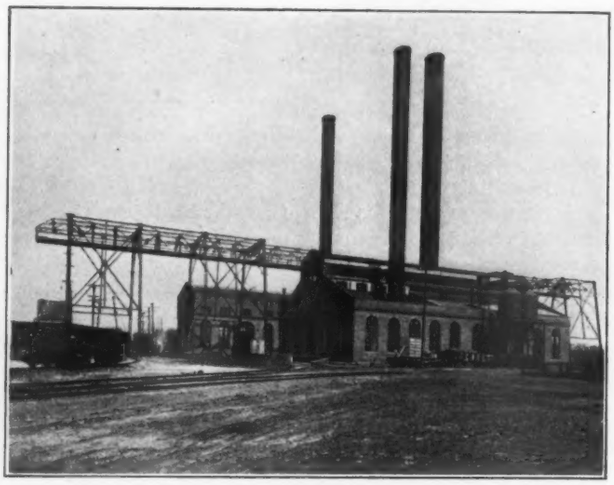


FIG. 2—BLUE ISLAND GENERATING STATION

Erected six years ago with an initial equipment of 3000 kw in steam turbines, the station has since undergone an extremely rapid growth to keep pace with the mounting power needs of the nearby industrial district. With its second 7500-kw turbine unit now being installed, the Blue Island station will shortly have a total rating of 22,000 kw. Its monthly output now reaches 3,500,000 kw-hr., and despite its use as a "swing" station operated along with water-power plants run fully loaded twenty-four hours per day, the Blue Island station daily load-factor is well above 60 and 65 per cent, as shown by the accompanying load curve.

Fuel for this plant is handled by means of a 3-ton telpher grab bucket whose car travels on a runway 76 ft. high. Carried on steelwork this runway passes above the overhead bunkers and extends out of doors for distances of

FIG. 3—BOILER ROOM OF BLUE ISLAND STATION

100 ft. over concrete-lined coal-storage pits in a line with the boiler-room building. On the grounds above the station there is storage capacity for 12,000 tons of fuel. From these piles or from the cars a locomotive crane delivers the coal to the crusher. The latter discharges into the concrete pit whose 750-ton capacity would provide fuel for several days' operation in event of accident to the coal-handling equipment. The 3-ton bucket is handled by a 52-hp hoist motor and a 35-hp travel motor, both three-phase alternating-current machines. The overhead bunkers in the boiler room will hold 1100 tons of the Illinois coal used as fuel at this plant.

For generating steam at 200 lb. pressure per sq. in. and with 100 deg. Fahr. of superheat, the boiler equipment comprises six 500-hp and eight 400-hp Babcock & Wilcox units, all arranged with mechanical stokers. Each boiler is also provided with a steam-flow meter indicating its output at any instant. The flue gases of the plant are carried aloft through three steel stacks, one 260 ft. high and 11 ft. in diameter, the others 190 ft. high and 9 ft. in diameter. Ashes are removed by a Green suction conveyor which delivers to ash tanks commanding a railroad track alongside the building. De Laval and Curtis-Worthington turbine-driven centrifugal pumps are employed for boiler-feed purposes.

The prime-mover equipment at Blue Island comprises a 7500-kw, 4500-volt, 25-cycle horizontal turbine set; a 7500-kw, 12,000-volt, 60-cycle unit in process of being in-

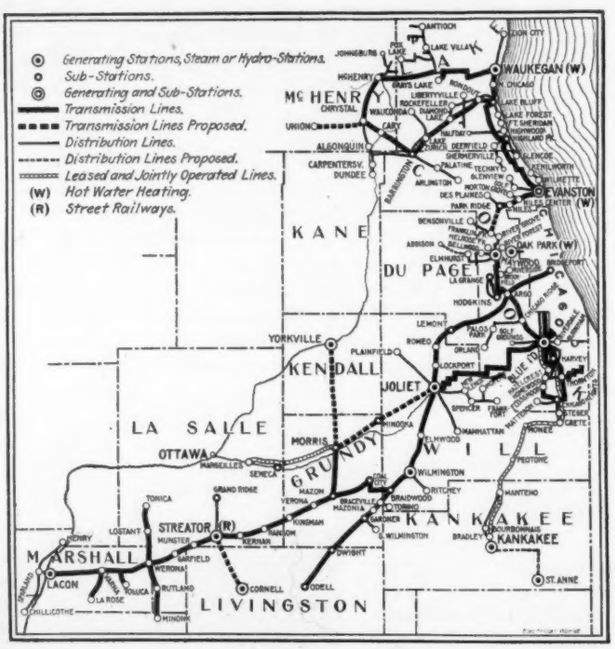


FIG. 4—SYSTEM OF PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

stalled; a 4000-kw, 12,000-volt, 60-cycle horizontal unit and one 2000-kw and one 1000-kw vertical turbine set generating 25-cycle current at 9000 volts. All machines are of the General Electric-Curtis type with the exception of a 100-kw Westinghouse turbine exciter set. Cooling water for the Worthington surface condensers is taken from the Little Calumet River which flows alongside the plant site.

For converting a portion of the 9000-volt, 25-cycle output to 60-cycle energy at 4000 volts for lighting and general power purposes two 2000-kw vertical frequency-changer sets are installed. Part of the transformers which step up to 33,000 volts are of the air-blast type. These are supplied with air through the bus compartments by motor-driven blowers on the main floor, which carry an air pressure of 1.2 in. of water column.

Connecting the Blue Island station with the system of the Commonwealth Edison Company through the latter's Roseland substation there is an 18,000-volt, 25-cycle No. 0 tie cable, as well as a 12,000-volt, 60-cycle tie line which, by throwing over disconnecting switches, can also be made available for 9000-volt, 25-cycle operation. In case of

emergency auxiliary service can be supplied over these lines, although with its present equipment the Blue Island plant no longer depends upon the Fisk and Quarry Street stations for assistance in carrying the load of the southern system. Attempts have also been made to synchronize Blue Island with both Fisk Street and the Joliet plant, the latter being at the time paralleled with the Commonwealth Edison system, but owing to the presence of several frequency-changer sets in the loop thus formed, it has not been possible to bring about such double-paralleled operation without kicking out the circuit-breakers.

The Blue Island turbine station produces a kilowatt-hour with a consumption of 4.3 lb. of mine-run Illinois coal, compared with which an average fuel economy of 5.7 lb. per kw-hr. is obtained for all the steam plants of the Public Service Company's system. Of these total steam-station operating costs, 52 per cent is expended for fuel, 30 per cent for labor and 18 per cent for miscellaneous items.

WATER-POWER PLANT AT KANKAKEE

The best hydroelectric-plant practice of the company is exemplified in the recently completed Kankakee water-power plant built as an adjunct to the steam relay station

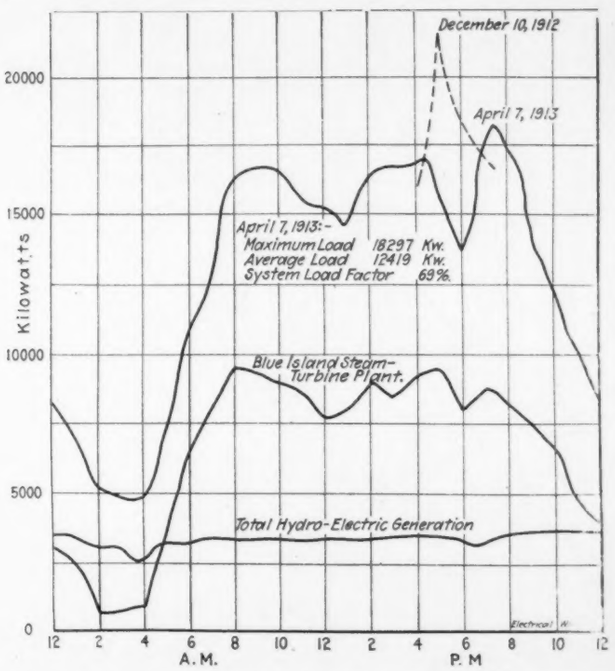


FIG. 5—DAILY LOAD CURVE OF THE BLUE ISLAND GENERATING PLANT AND SYSTEM

in that city. Developing a fall of only 8 ft. in the Kankakee River, 600 electrical kw is here made available through the means of a pair of vertical-shaft waterwheel units which are unusual on account of the very low head and large volume of water to be handled.

Each of these waterwheels comprises a pair of 5-ft. runners which discharge into separate draft tubes, one below the other. These concrete-lined passages molded in the station foundations measure 9 ft. by 16 ft. in section. The 8.5-in. steel shafts connecting the runners with the rotating field members in the generator room above measure 41 ft. in length. The entire rotating mass, including the shaft, runners and alternate field, totals 17 tons, the full weight of which is carried by a thrust bearing located just below the generator-room floor. On account of the large quantities of water to be handled in these turbines because of the low operating head, special Lombard oil governors capable of exerting effective efforts of 10,000 ft.-lb. were required to control the wickets admitting the supply to the runners. The units operate at 72 r.p.m. The waterwheels were furnished by the S. Morgan Smith Company and the alternators by the Westinghouse Electric & Manufacturing Company.

In the steam plant adjoining this water-power addition there are installed a 500-kw horizontal Westinghouse-Parsons turbine-alternator unit and an auxiliary 100-kw engine set. The city of Kankakee is lighted from this

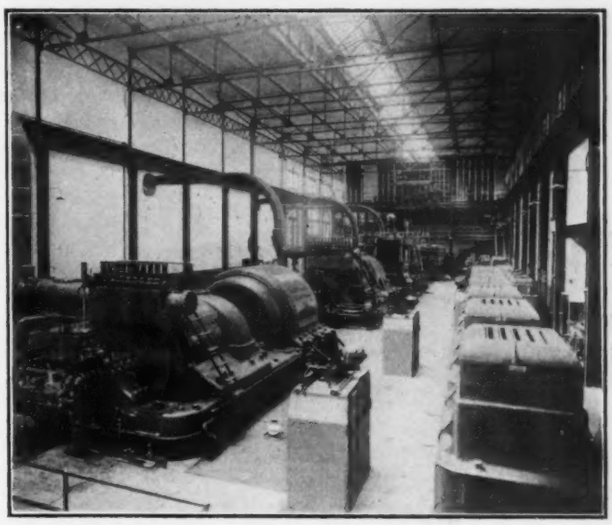


FIG. 6—TURBINE ROOM OF BLUE ISLAND STATION

station, which also transmits energy to Manteno, Bourbonnais and Bradley and supplies power for the Chicago & Interurban Traction Company, operating between Chicago and Kankakee.

As shown by the accompanying load curve, the water-power plants of the company are operated at as nearly full load as possible day and night, in this way taking the fullest advantage of the water-power available, while the variations in load are carried by the steam stations. Nearly 25 per cent of the total system output is produced in these water-power plants.

LOAD DISPATCHING BETWEEN PLANTS

The work of load dispatching to follow the varying de-

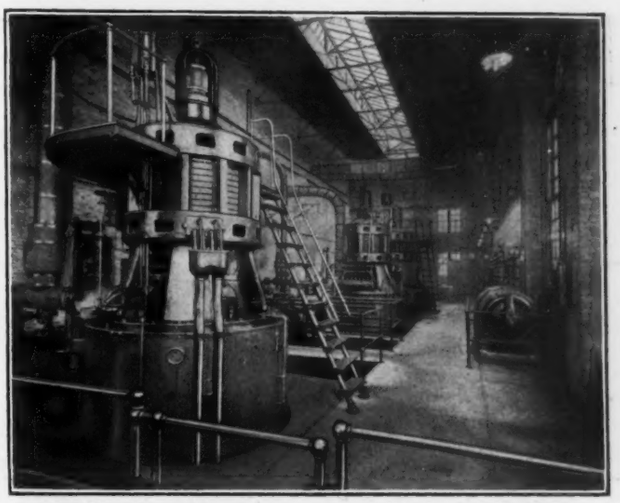


FIG. 7—INTERIOR OF MAYWOOD GENERATING STATION

mands for power through the hours of the day is in charge of "system operators," the one for the southern system being located at Joliet and that for the northern system at Evanston. These system operators issue orders by telephone for the starting of various units, operation of switches, etc. While their authority is complete, the local

operators are at times permitted to exercise their own judgment when necessary if on account of telephone-line interruptions the system dispatcher cannot be reached. With the great territorial extent of the present systems the orders of the dispatcher need not be rigidly depended upon in minor local situations, and in emergencies the local operators must be left free to use their best judgment.

When a switch is ordered opened by the load dispatcher a red warning card marked "Hold" is affixed to the handle. On the back of this blank there is also entered the description of the circuit, name of the employee for whom it was opened, name of the one issuing the order, probable time of completing work, name of operator placing and removing card, dates, etc. When the line is released the card must be mailed to the load dispatcher, who indorses and files it as a complete record of the interruption.

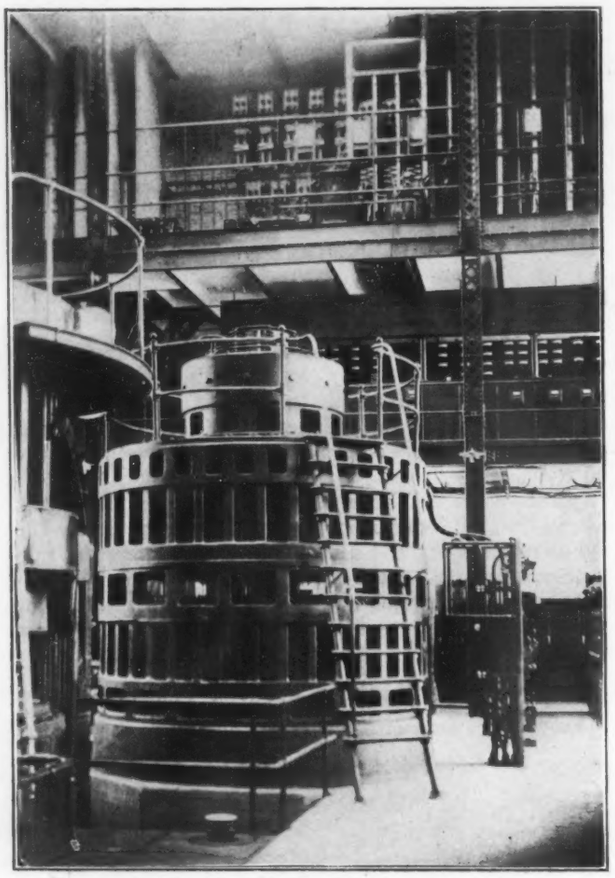


FIG. 8—VERTICAL FREQUENCY-CHANGER SET IN BLUE ISLAND STATION

Transmission-Line Construction

For the southern system 33,000 volts has been adopted as the standard transmission pressure. The same specifications are being extended to all new construction on the northern system, although this group is now being operated at 20,000 volts, with a number of 4600-8000 volt four-wire subsidiary circuits. The main 33,000-volt lines employ No. 2 copper, while branch circuits have been built using No. 4. Poles are set forty-four to the mile, 30-ft. timbers or longer ones, with 7-in. tops, being the standard.

Between main generating stations the "type A" trunk-line construction employed as the standard provides for carrying one or two circuits, each in its own plane, on a 10-ft. cross-arm. Between conductors 3-ft. intervals are maintained. A bayonet angle supports the overhead ground wire, which is earthed at every fifth pole with a conductor of the same size as the line wire. Ground cylinders are specified for the earth connections. Below the top cross-arm the pole is gained for a second arm if needed, and also for a telephone line.

A form of double-arm construction, designated as "type B," is used on other important lines where it is not expected that a second circuit will soon be needed. Each arm carries two pins, one of the upper pins supporting the ground wire, which is earthed as before to buried cylinders. Approximately 3-ft. distances are preserved between conductors. In some instances this type of construction has been temporarily employed for 2300/4000 or 4600/8000-volt distribution, the ground wire being used as the neutral of the four-wire circuit. Such lines can later be converted to 33,000-volt operation when needed as a part of the main transmission system. This 4600/8000-volt plan of distribution is found to be of special convenience, however, in avoiding the necessity for substations at the smaller points, since regulators may instead be installed at nearby stations already in service. In such cases 4600-volt distribution transformers are somtimes employed, although it is usually necessary to install first-line transformers of two-to-one ratio to step down to the standard distribution pressure of 2300 volts.

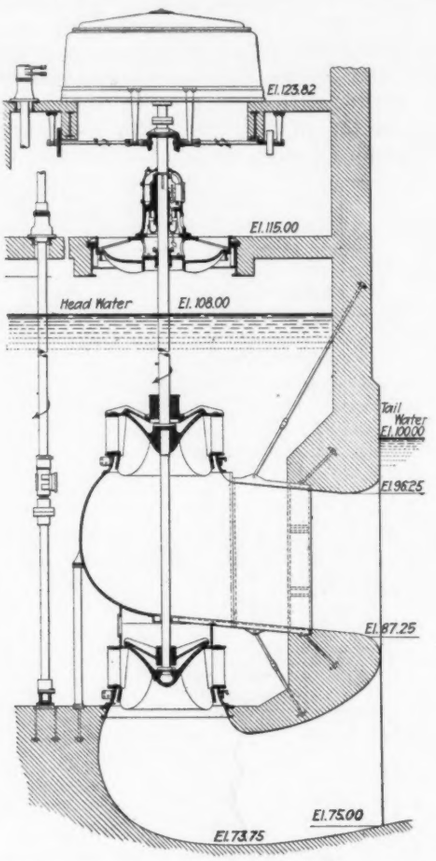


FIG. 9—SECTION THROUGH DOUBLE-RUNNER UNIT AT KANKAKEE, ILL.

The company's "type C" construction for branch-line use where limited investment is justified utilizes a single 4-ft. arm for carrying the two lower conductors, with the third wire mounted on the peak of the pole.

Wherever possible the transmission lines follow railroad rights-of-way, the poles being set several feet over the property line on the ground of adjoining farms by agreement with the owners. For patrolling the lines good use is made of gasoline "speeders," of which the company has several. These little "automobile hand cars" run on the standard-gage tracks and make good time while carrying a full crew and complete line-repair equipment.

It is the plan ultimately to complete cross-connecting lines between the present radial transmission circuits which have naturally branched out from the main centers of distribution. In this way all towns will be put on transmission loops so that in case of breakdown in one direction the second line will be available for service. Already, as the map shows, the work of closing in these tie lines has proceeded to a point where probably half the communities which are reached by the transmission lines have at least two alternative sources of supply.

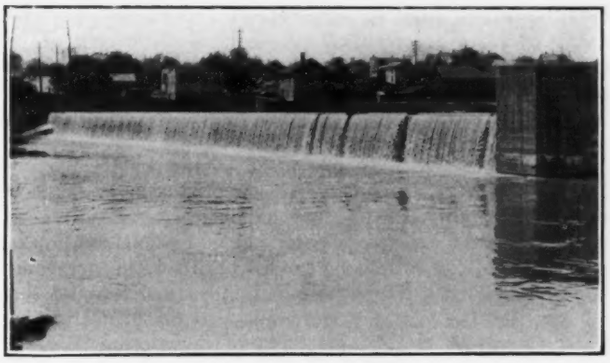


FIG. 10—WATER-POWER PLANT AT JOLIET

Substation Structures

A number of handsome and serviceable substation buildings have been erected by the Public Service Company to house its transforming apparatus at the larger distribution points. The substation at Lake Bluff, for example, cost $19,000 for the building alone and is of undoubted architectural merit. But before this point was finally selected as a distribution center a temporary substation was first erected near by at a cost of $425 to give the location a thorough trial. In planning this temporary wooden building the architect was instructed to embody a design of minimum expense for substation purposes with a house that could be later converted into a cottage for the operator in case a permanent station structure was decided upon.

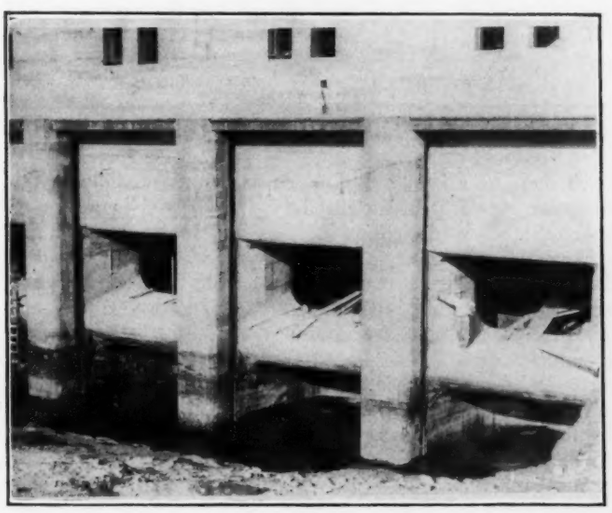


FIG. 11—DOUBLE-DISCHARGE TUBES FOR KANKAKEE PLANT

For two years the little building served its purpose as a substation, meanwhile demonstrating the fitness of the location as a distributing point. The present handsome brick, concrete and steel building (Fig. 15) was then put up, and the temporary structure was moved back and a room added, making it into an attractive little cottage for the operator.

The substation building at Chicago Heights (Fig. 19) is of a similar design and illustrates a case of the replacement of a former generating station now shut down and converted into a warehouse. The substation now supplies the service which was formerly generated in the old steam plant.

In the larger substation installations aluminum-cell lightning arresters protect the high-tension lines, but in the case of the outdoor pole-platform transformer mountings, of which there are a great number serving small communities, the electrolytic cells are dispensed with, the simple horn-gaps used being grounded directly through resistors. Both air-blast and self-cooling, oil-insulated transformers are employed as standard equipment for indoor stations. Where possible, as already intimated, such indoor substations are made automatic regulating points for several nearby towns fed over 4600/8000-volt lines. Both induction-type and auto-transformer type of regulator apparatus are employed for this voltage control.

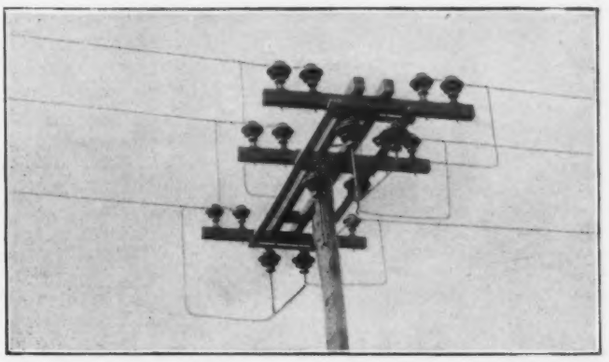


FIG. 12—POLE-TYPE FUSES ON TRANSMISSION LINE

Outdoor Transformer Mounting

To avoid the investment in substation buildings for serving small communities, a type of wooden-pole platform mounting has been developed for carrying transformers up to 75 kw in rating. An accompanying illustration shows clearly the arrangement by which the high-tension line is tapped through carbon-tetrachloride fuses and the secondary circuits led off. Another picture shows a pole installation of these same S. & C. fuses, which have been used with success on the lines of the Northern Illinois company, experimental installations having now been in service for a number of months. The fuse link is held in tension by

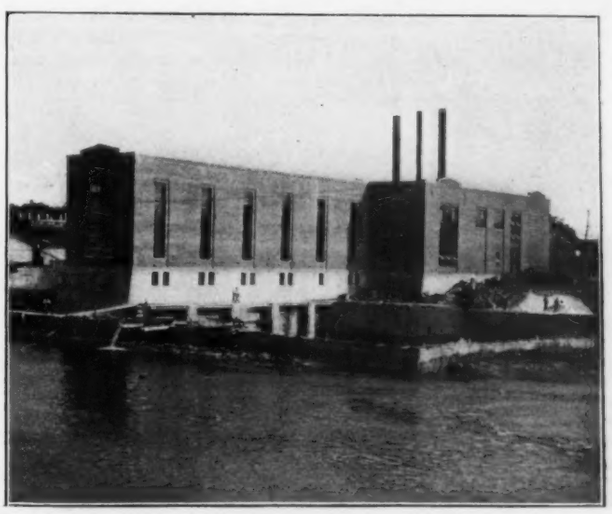


FIG. 13—WATER-POWER PLANT AT KANKAKEE

spiral springs, the whole being inclosed in a glass tube filled with carbon tetrachloride.

One of the determining factors in the selection of 33,000 volts as the transmission-line potential was the economical use of transformers as small as 25 kw for furnishing service to small communities. In such towns having loads around 100 kw the drop over 10 miles of line will be so small as to render unnecessary the use of regulating apparatus.

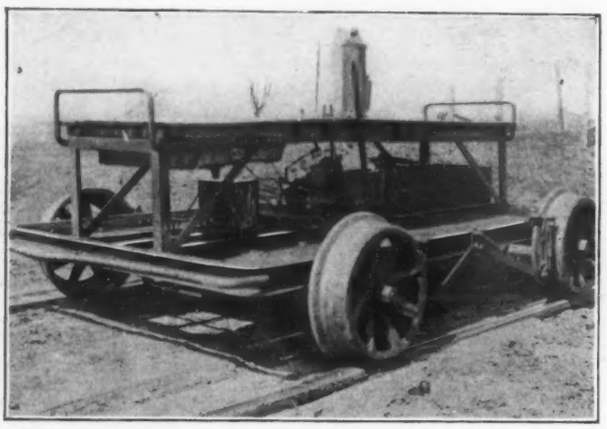


FIG. 14—RAILROAD SPEEDER USED FOR LINE MAINTENANCE

Operating Organization of Staff

For purposes of operation the territory reached by the lines of the Public Service Company of Northern Illinois is divided into four divisions and thirteen districts, each of the latter being designated by a letter which is in several cases the initial of the principal town. Each district is in charge of a district superintendent who maintains an office in the largest community, and to him are detailed his district salesmen, inspectors, etc., by the departmental heads. The four division superintendents act also as district superintendents for their own districts, receiving in addition reports from superintendents of the several other districts for which they are held responsible. The total number of the company's employees in all departments at present reaches 1500.

All matters of plant and substation operation and construction are in charge of the general superintendent of the company, who has his electrical and engineering assistants to give specialized supervision to the work. By this arrangement the local superintendents are relieved of authority in connection with station operation, which is the province of the operating department, although the superintendents do have charge of maintaining the transmission and distribution lines in their territories up to the substation entries.

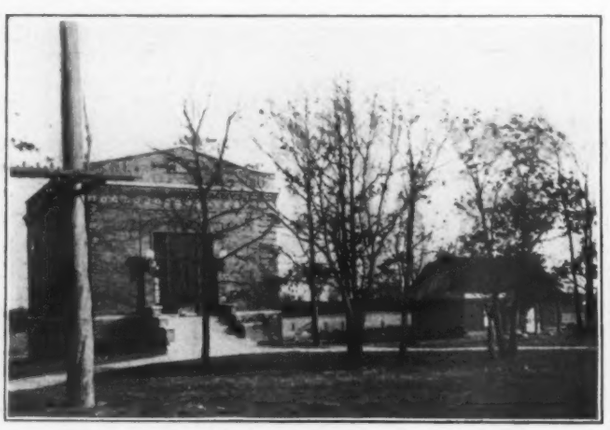


FIG. 15—LAKE BLUFF SUBSTATION AND TEMPORARY STRUCTURE

At district headquarters and in towns where the business warrants it attractive offices are maintained, usually including a display of electrical appliances. In smaller communities arrangements are made with a local druggist or other merchant, who receipts for bills and exchanges lamps on a commission basis or for a fixed sum per month, usually credited on his lighting bill. Minor repairs and replacements of fuses are handled by the local electrician or by one of the company's own men dispatched by motorcycle from the district headquarters.

Employees' Welfare and Safety Work

Every candidate for employment by the Public Service Company, whether a prospective office, station or outdoor worker, is required to undergo a physical examination at the hands of the company's physician. This examination is in general similar to that demanded by life-insurance companies and has as its purpose not only to determine the applicant's fitness for the work but also the protection of fellow-employees against infection of disease.

At intervals employees receive instruction and demonstrations in resuscitating persons from electrical shock.

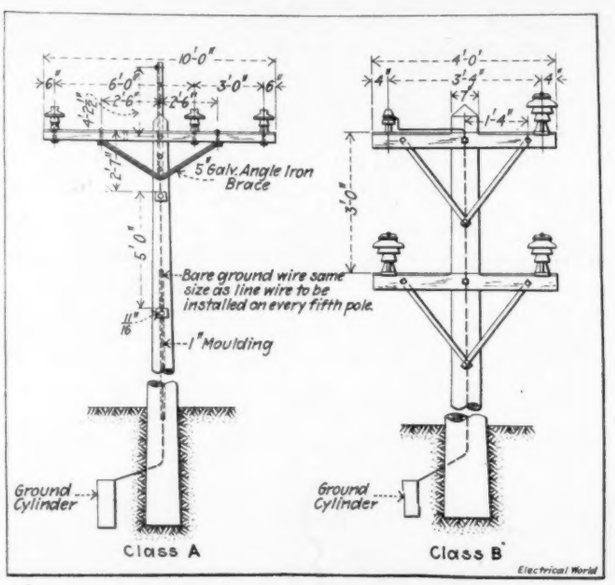


FIG. 16—MAIN AND BRANCH LINE CONSTRUCTION

Such dangers are also minimized as far as possible in the company plants, it being the duty of a special inspector to visit regularly the various stations and to recommend improvements conducive to personal safety.

All charged parts carrying 440 volts are higher are screened, while bus-pipe structures, transformer and apparatus cases, machine frames, etc., are all securely grounded. Guards are placed about flywheels and countersunk set screws are required on all shafts. Removable railings are set up to guard dangerous positions, their pipe standards dropping into sockets permanently embedded in the concrete floor.

Accidents that have occurred in the company's own stations and elsewhere are studied and the lessons to be drawn are applied to safety improvements. For example, all downspouts on substation structures have now been thoroughly grounded following a serious accident in which a gutter became crossed with a line wire. Oil switches are recommended for all purposes above 440 volts, and fuses are being inclosed in flash-proof covers. The use of rubber gloves, linemen's protectors, etc., is insisted on whenever lines have to be handled "hot." Lines opened for men to work in dangerous positions have red cards attached to the

switch handles, explaining the purpose of the interruption and by whom it was ordered. When the switches are finally ordered closed these cards are mailed in to the chief dispatcher, furnishing him with a complete record of the incident. Rubber mats are laid in front of all switchboards carrying 440 volts or higher, while such boards in the older plants having insufficient clearance at the rear are inclosed in order to prevent use as a passageway by careless persons.

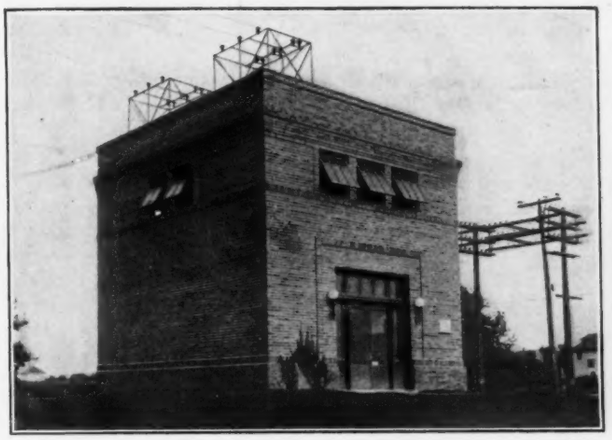


FIG. 17—SUBSTATION AT BARRINGTON, ILL.

The safety inspector gives talks on the subject of accident prevention before district meetings, illustrating his remarks with lantern slides. Addresses on the same topic have also been presented before the Public Service Company's section of the National Electric Light Association, which has an enrolment reaching 400.

FIG. 18—ELECTRICALLY OPERATED STONE CARS IN QUARRY

Of the 81,125 kw of total connected load on the lines of the Public Service Company of Northern Illinois, 38,732 hp is in motor load and 6100 kw in rotary converters supplying interurban railways.

Besides furnishing energy to operate about one-half of the 70-mile Chicago-Milwaukee interurban line, the company supplies practically all the power needs for the Chicago & Interurban Traction Company's Chicago-Kankakee line, the Chicago & Joliet Electric Railway, the Joliet & Southern Traction Company's lines from Joliet to Aurora and to Chicago Heights, the Bloomington, Pontiac & Joliet Electric Railway Company's line from Pontiac to Odell, and the Streator city system which the Public Service Company itself owns.

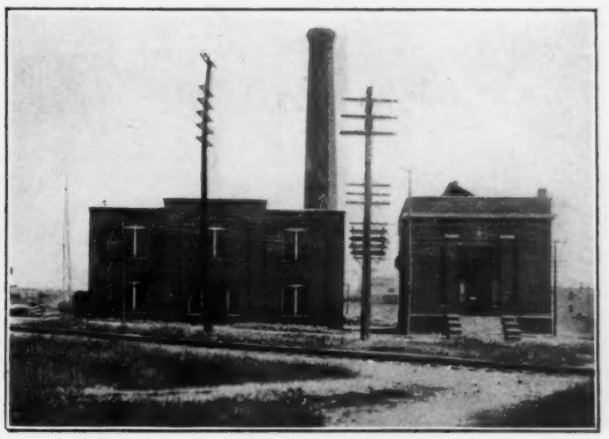


FIG. 19—CHICAGO HEIGHTS STEAM PLANT AND SUBSTATION

The industrial applications of motor service from the interconnected system are both varied and extensive, ranging in character from steel making and fabrication to amusement-park operation. Among the large mill and factory customers using more than 100 hp are the following, with their connected loads, the latter reaching 1500 hp in some instances and making a striking total:

Iron and Steel Industries.—American Brake Shoe & Foundry Company, Melrose Park, 250 hp; American McKenna Process Company, Joliet, 348 hp; Bliss & Laughlin, Harvey, 190 hp; Chicago Hardware Foundry Company, North Chicago, 500 hp; Edgar Allen American Manganese Steel Company, Chicago Heights, 1500 hp; Franklin Park Foundry Company, Franklin Park, 266 hp; J. G. Heggie, Joliet, 312 hp; Joliet Bridge & Iron Company, Joliet, 589 hp;

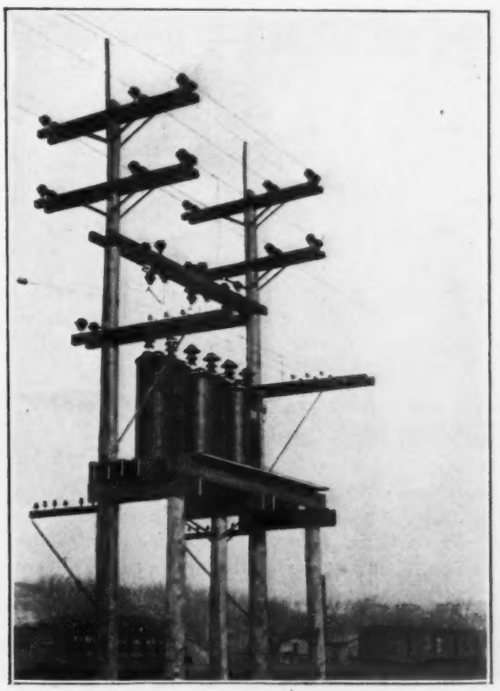


FIG. 20—OUTDOOR SUBSTATION

Joliet Rolling Mill Company, Joliet, 297 hp; King & Andrews Company, Chicago Heights, 140 hp, and Mark Manufacturing Company, Evanston, 1500 hp.

General Manufacturing.—American Straw Board Company, Wilmington, 450 hp; Barrow Lock Company, Lockport, 150 hp; Bray & Kates Company, Arlington Heights, 165 hp; The Buda Company, Harvey, 300 hp; Central Locomotive & Car Works, Chicago Heights, 500 hp; Cyclone Fence Company, North Chicago, 125 hp; the Forsyth Brothers Company, Harvey, 300 hp; Gerlach-Barklow Company, Joliet, 171 hp; Illinois Iron & Bolt Works, Carpenterville, 150 hp; Ingalls-Sheppard Forging Company, Harvey, 155 hp; Mears-Slayton Lumber Company, Evanston, 120 hp; National Match Company, Joliet, 228 hp; Quaker Oats Company, Joliet, 136 hp; Streator Metal Stamp Company, Streator, 164 hp; Victor Chemical Company, Chicago Heights, 600 hp; Wilder-Manning Tanning Company, Waukegan, 382 hp.

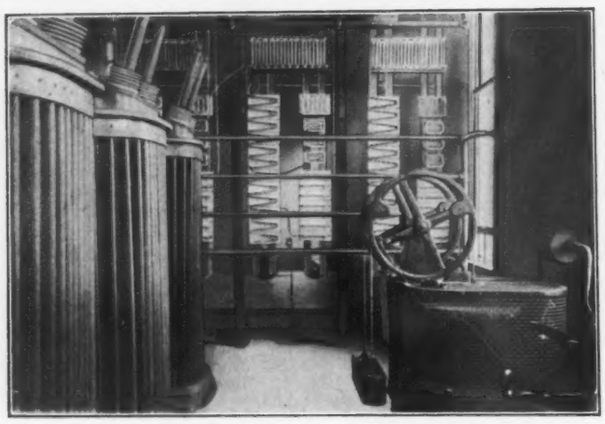


FIG. 21—SAFETY PRECAUTIONS IN GUARDING LIGHTNING ARRESTERS, REGULATOR AND TRANSFORMERS

Miscellaneous.—Chicago, Rock Island & Pacific Railway shops, Blue Island, 600 hp; Elgin, Joliet & Eastern Railway shops, Joliet, 450 hp; Forest Park Amusement Company, Forest Park, 134 hp; Green & Sons, Palos Park, 500 hp; A. Groth & Company, Joliet, 157 hp; Illinois & Michigan Canal, Bridgeport, 600 hp; Illinois Valley Coal Company, Sparland, 160 hp; Jos. Joseph & Brothers Company, Chicago Heights, 150 hp; Midlothian Country Club, Midlothian, 150 hp; Society of the Divine Word, Techny, 206 hp; United Car Company, Chicago Heights, 130 hp; United States Equipment Company, McCook, 100 hp; Vulcan Louisville Smelting Company, North Chicago, 155 hp.

Stone Quarry and Gravel-Pit Operation

Several of the characteristic long-hour applications of central-station service in the Chicago suburban district result from the peculiar geological formation of this region, where in ages past the retreat of the glaciers deposited upon the underlying blue-white stratified limestone thick surface beds of sand, gravel and clay. With active building operations always under way in Chicago, great quantities of brick, crushed rock, gravel, sand, etc., are required, and in the handling and preparation of this material electric drive has now largely replaced steam power.

Among the brick and clay-product manufacturers who use Public Service power are the Acme Brick Company, Chicago Heights, 250 hp; Illinois Shale Tie Company, Coal City, 175 hp; W. E. Pratt Manufacturing Company, Joliet, 280 hp, and Whiteacre Fireproofing Company, Chicago Heights, 300 hp.

Another important industry in this region is the production of crushed stone, an application of motor-drive which provides long-hour loads for the central station. One of the largest of these plants is that of Dolese & Shepard, located near the Chicago Drainage Canal at Hodgkins, Ill. The company has a connected load of 2660 hp. Among the interesting applications of motor drive at the Dolese & Shepard plant is the operation of a number of electric stone cars which are controlled from the tower seen in the illustration, Fig. 18. Other large users of central-station energy in the stone industry are the Chicago Contractors' Supply Company, Joliet, 250 hp; Chicago Union Lime Works Company, McCook, 480 hp; Federal Stone Company, La Grange, 335 hp; Illinois Stone Company, Lemont, 345 hp; Michigan Central Railroad, Joliet, 380 hp; O'Laughlin Stone Company, Bellwood, 435 hp, and the Wabash Railroad Company, Richie, 175 hp.

Owing to its seasonable demand, the electric operation of the many sand and gravel pits which abound in the Chicago region affords desirable day business during the spring, summer and fall months. The following is a list of some of those now operated from the lines of the Public Service Company: American Sand & Gravel Company, Carpentersville, 140 hp; Joliet Sand & Gravel Company, Joliet, 325 hp; Joliet Sand & Gravel Company, Plainfield, 190 hp; Knickerbocker Ice Company, Fox Lake, 180 hp; Lake County Gravel Company, Libertyville, 105 hp; Lake Shore Sand & Gravel Company, Algonquin, 130 hp; Reinert Brothers, Algonquin, 140 hp.

The equipment of the Reinert pit at Algonquin (Fig. 24) is one of the most modern installations in the local field. The mixed gravel as quarried is passed through a crusher driven by a 50-hp motor and is then elevated by the 50-hp motor-driven inclined conveyor to the revolving screens, where after being washed it is separated into three sizes. The pump which circulates the supply of water between the settling tank and washer is driven by a 30-hp motor. All of the motors are three-phase, 440-volt machines and are manipulated from a control house near the foot of the conveyor. This washing and screening equipment is capable of handling forty carloads of gravel per day and has loaded fifteen carloads in four hours. The pit is started up about the first of April and is run until the end of October, operating daily from 7 a. m. to 6 p. m.

Town Water Supply Pumping

From the standpoint of a long-hour load in suburban residential districts, an interesting aspect of the company's service has been the development of town water-works pumping, which affords extremely desirable off-peak business. The water supply for more than thirty of the communities in the company's territory is now being pumped electrically with central-station energy.

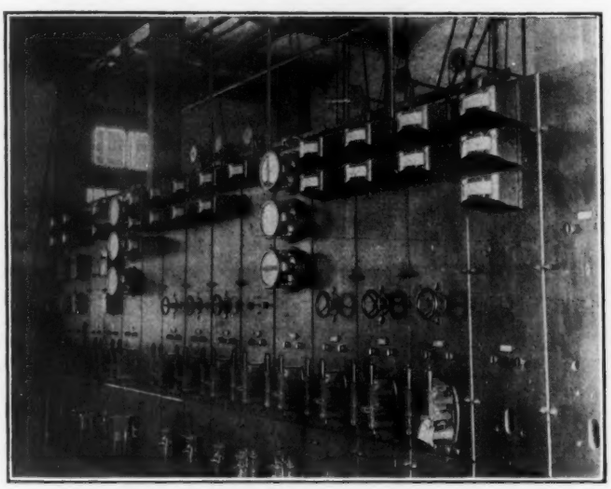


FIG. 22—SWITCHBOARD IN BARRINGTON SUBSTATION

Among the towns thus served are Antioch, Crystal Lake, Palatine, Cary, Lake Zurich, Fort Sheridan, Barrington,

Lake Bluff, Park Ridge, Franklin Park, River Forest, La Grange, McCook, Lamont, Harvey, Flossmoor, Chicago Heights, Steger, Joliet, Crete, Wilmington, Coal City, Braidwood, Bourbonnais, Kankakee, Dwight, Odell, Lacon and Chillicothe. At Joliet the city pumping load in three plants totals 500 hp. The Oak Park station has 220 hp in motors.

In some of these instances the Public Service Company owns and operates the water-works systems, as is the case at Harvey, La Grange, Chillicothe and elsewhere. In other places it furnishes both the electrical energy and the operating service, in this way keeping control of the hours of pumping so as not to conflict with its electrical peaks. Where standpipes are installed as the company recommends pump operation can be shut down during the hours of lighting load and water supplied from the reservoir. By itself supervising the pumping plant the company is able to maintain the equipment in better shape and thus to secure higher operating efficiencies.

A kilowatt-hour rate for energy supplied is regarded as the most desirable for this class of pumping business, since contracts taken on the basis of gallons pumped are likely to result in variable returns depending on the level of the water in the wells, condition of machinery, etc.

For its pumping service the company's rate to municipalities averages from 2.5 to 3 cents per kw-hr., although some contracts have been taken on a delivery basis of about 5 cents per 1000 gal. pumped, the company to have supervision of the pumping plant.

In most of the cases cited the company has converted former steam-driven water-works plants to electrical operation, but in some instances it actually promoted water systems in new communities that were formerly without modern conveniences. Following upon the heels of such an initial improvement, there is usually noticed a quickened civic spirit in the community, and shortly, it is said, pavements, street lighting, etc., take their place along with the electrically operated water-works. In several such cases the reduction in insurance rates following the introduction of a water-works system has more than paid for the cost of the latter's operation.

Electricity for Lighting in Suburban Districts

The standard schedule of rates for lighting service throughout the company's territory is 14.5 cents per kw-hr.

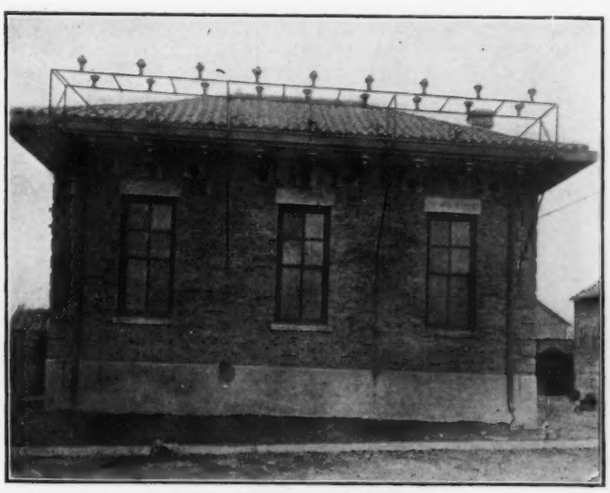


FIG. 23—SUBSTATION AT MAZON

for the first thirty hours' use of the maximum and 8 cents per kw-hr. thereafter. For prompt payment within ten days, however, a discount of 1 cent per kw-hr. is allowed, making the net rate 13.5 cents and 7 cents per kw-hr. Free installations and free renewals of carbon lamps are made, while proportional credit is allowed on tungsten units of 25 watts and more.

Maximum demands to be employed in applying the rate schedule are usually estimated on the basis of the customer's total number of connected sockets, using multiplying factors given in a booklet furnished employees. If desired, the company will, however, install a maximum-demand meter, accepting this reading as the highest rate of consumption during the month.

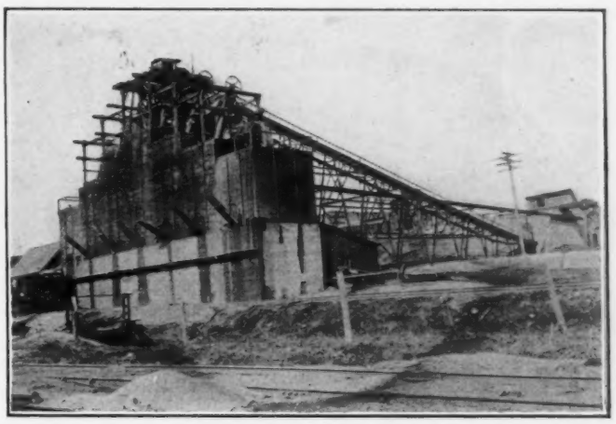


FIG. 24—ELECTRICALLY OPERATED SAND AND GRAVEL PIT

For the convenience of customers, an emergency service is maintained for making minor repairs, troublemen being dispatched to replace fuses, repair sockets, mend cords, etc. This service is all without cost to the customer unless there is considerable outlay for material. Motorcycles, of which the company has nearly forty in addition to an equal number of automobiles, are found of great service for conveying the troublemen about their districts.

On the basis of its twenty-four-months-to-pay house-wiring offer, many new residence users are being added to the company's lines. The wiring jobs are preferably turned over to a local contractor, although the Public Service Company is itself equipped to install wiring if satisfactory work cannot be obtained from outside tradesmen. By means of a unit outlet schedule the cost of wiring can be estimated very closely in advance. If the customer elects to take advantage of the plan of twenty-four monthly payments, the company pays the contractor 90 per cent of the full estimated figure on completion of the work, itself carrying the account until the property owner has paid up the amount at the end of two years. Where agreeable the services of local contractors are, as already mentioned, utilized for making minor free repairs for customers, answering questions, exchanging lamps, etc.

Besides advertising in 110 local newspapers, the commercial department of the company conducts aggressive development campaigns by circular letters sent to prospective and present customers.

Applications of Electricity in Rural Districts

In the rich farming and dairying lands of McHenry, Lake and Cook Counties, surrounding the Public Service Company's district headquarters at Crystal Lake, the distribution of electricity for farm use has been carried out on an unusual scale. In this district alone sixty-eight farm customers are now being furnished with electric service from the 8000-volt and 2300-volt lines which thread the countryside in that vicinity. The local rural connected load aggregates 122 hp in single-phase motors and 2215 50-watt equivalents in lamps. Besides the practical agriculturists of the region, there are a number of fine country estates in the neighborhood adding their lighting and power demands to the scattered rural loads along the transmission network.

Exclusive of the use of electricity for lighting purposes, the principal power application on these farms is the motor

drive of pumps for farmhouse supply, watering stock, etc. All motors are of the single-phase type and none exceeds 10 hp in rating. Every farm customer in this region has an electric iron and many of them have motor-driven washing machines and vacuum cleaners. Motors are used to drive feed grinders, bone mills, milking machines, mangles, lathes, refrigerating outfits in dairies and other farm machines. Five rural customers in this district have complete electric ranges.

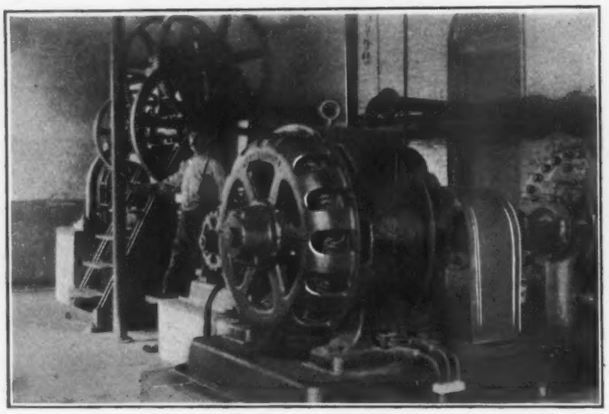


FIG. 25—MOTOR-DRIVEN WATER-WORKS PUMPING PLANT AT MORRIS, ILL.

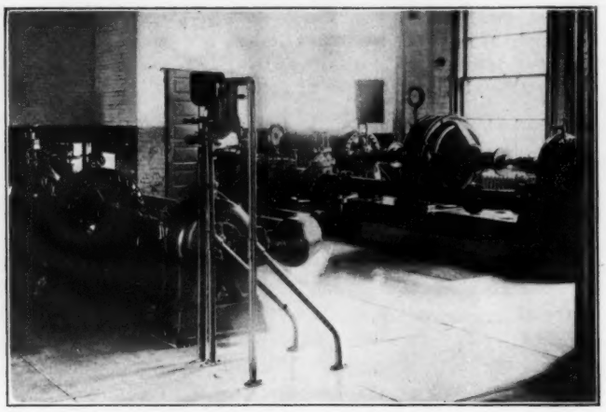


FIG. 26—MOTOR-DRIVEN PUMPING STATION OF LA GRANGE, ILL., WATER WORKS

The mistress of a fine country estate, 4 miles from the nearest town and 25 miles from a paved street, makes almost daily use of an electric brougham in which she journeys back and forth to town over roads and hills that would discourage many drivers of touring cars. Her garage is completely equipped with a rectifier charging outfit. She declares herself to be well pleased with her electric vehicle, which is less troublesome to make ready and use than to hitch up a horse or to drive a gasoline car the distance to town.

Rural customers obtain the benefit of the same schedule of rates for lighting and power purposes received by the company's consumers in town. The standard lighting rate is 13.5 cents net per kw-hr. for the first thirty hours' use of the maximum and 7 cents per kw-hr. thereafter, if paid within ten days of date of bill; otherwise the rate is 14.5 cents and 7 cents.

Although with the aid of motorcycles the farm meters are read monthly in summer, during the winter months when the roads are bad the inspector gets around only once in three months. On these infrequent occasions, however, he leaves with the customer a supply of meter-dial post cards on which the farmer at monthly intervals copies down the meter pointer positions, mailing the card to the district office. Unless in evident error, this reading is taken as the regular meter indication for the period covered and the customers are billed accordingly. If the farmer has clearly set down a wrong position, the reading is discarded and he receives a maximum bill for that month, with a note to the effect that at a later call the inspector will check his observation and a corrected bill will be rendered. The reports received from the farm users are, however, usually quite dependable. This class of customers has been found, furthermore, to be thoroughly responsible, and business with them involves no possibility of bad debts. The average farmer, it is also of interest to note, will agree cheerfully to a service proposition stated as "$24 a year," whereas he would view with alarm a similar proposal to pay $2 a month.

Data on Farm Operations

Owing to his early hours for rising and retiring it will have to be admitted that the farmer is not a very good lighting customer, although in the winter months the local lines show a distinct pre-dawn peak due to the lighting of houses and barns incident to early morning chores. For these dark months the farm lighting bills may average several dollars, but in the summer they sometimes barely exceed the 50-cent minimum. Taking at random, a few farm lighting and power installations in this district, the ranges of energy consumption per month recorded during the year are shown in Table II, printed in this column.

As another example, one dairyman customer of the electric company by operating his 10-hp, 10-in. grinder half an hour a day chops enough feed for his fifty head of cattle. At an equivalent rate of 7 cents per kw-hr., he pays about $14 a month for this service, which is less than the mill in town formerly charged him to grind the same quantity of food. His net saving in other directions includes the wear and tear in driving a team 3 miles to town and the time lost in waiting at the mill. In his own words, he can now grind a full supply in the time formerly required to load his wagon and hitch up the team. Moreover, this trip to the mill had to be taken during the daytime, whereas the grinding can now be completed during any half-hour at night. Without further handling the chopped food is thus delivered directly to the feeding bins.

Motor drive for silage cutting and filling also saves much work for the farmer. One farm customer near McHenry filled his 175-ton silo with 180 loads of corn in sixty hours at an expenditure of 215 kw-hr. This energy, billed at $15.85, made the net cost to him 11.5 cents per ton. A 7.5-hp, 220-volt, single-phase motor performed the work.

TABLE II—MONTHLY RANGE OF ENERGY CONSUMPTION

	Kw-hr.
Lighting only, twenty-eight lamps	9 to 20
Lighting only, twenty-nine lamps	29 to 45
Lighting only, nine lamps	3 to 23
5-hp feed grinder	10 to 25
10-hp feed grinder	20 to 80
10-hp grinder and 2-hp milker	200 to 250
2-hp milker, 5-hp dairy and 10-hp grinder	250 to 500

No difficulty seems to be experienced in getting farmers to use service; the trouble has rather been to convince those too far distant from the lines of the expense of reaching them. Where the farmer agrees to defray the cost of making the extension, the amount of his outlay will be credited to him in the form of receipted electric bills every alternate month until covered, although he pays, of course, the regular charge during the other months.

For 2300-volt farmer-line extensions No. 6 copper wire is used, carried on 20-ft. poles set at intervals of 100 ft. to 125 ft. The cost of such construction ranges about $750 a mile. Meter and transformer are furnished free of charge by the company, exactly as in the case of a town

customer. For safety the neutrals of all farm secondaries are grounded at the poles next to the transformers. When taps are taken from the 8000-volt lines Matthews pole-type switches are mounted just ahead of the transformers so that the customer's branch can be completely "killed" in case it is necessary to insert fuses or work on the lines.

The operation of automatic electric signals on steam railroads appears to be a relatively new application for energy tapped from rural transmission lines and one that will undoubtedly grow in importance by the double reason of its long-hour consumption and its political aspects when routing transmission lines over or alongside of railroad rights-of-way. Many signal systems are now using 60-cycle alternating current which can be conveniently furnished directly from the central-station lines. The Northern Illinois Company is already supplying energy to operate signals on more than 100 miles of one of the railroads traversing its territory.

The difficulty heretofore has been to assure continuity of signal service in case of transmission-line failure. A plan is now being developed to feed the signal circuit at a number of points 20 to 30 miles apart from different power lines, equipping each such feeding point with a no-voltage release switch, which on failure of the local source of supply will close bridging over to the next energized section.

Such railroad signaling service of the closed track-circuit type consumes from 0.25 kw-hr. to 0.50 kw-hr. per hour per mile of track and is practically a twenty-four-hour load, continuing as it does more than 8000 hours a year.

THE RESULTS OF CONSOLIDATED OPERATION

In the territories reached by the Public Service Company actual experience in replacing local plants with centralized generation and distribution has shown that while the investment outlay for the transmission lines and stations needed will be perhaps double that of the former local plants, the resulting economies of operation are such as to leave a very large saving per kilowatt-hour produced, after paying the charges on the additional investment.

Not only do both customer and operator benefit from the reduction in unit costs, but group operation makes available twenty-four-hour service of urban quality in communities where such a supply would be wholly out of the question under any other conditions. Again, for all branches of the industry there is assured a local development and diversity of electrical uses quite impossible under any plan of independent operation of small plants.

In general, the local generating stations that have been acquired and shut down by the Public Service Company were of types common among towns of this size. They were turning out their limited productions at costs of from 2.9 cents to 8.6 cents per kw-hr., the averages being in the region of 6.6, 6.2 and 5.5 cents per kw-hr.

One 100-kw steam plant furnishing 225,000 kw-hr. per year in a town of 1500 inhabitants expended $1,723 per year for coal and $1,261 for labor and other items, so that its fuel cost represented 58 per cent of its total $2,984 annual expense. In this case, however, the low unit cost of 2.9 cents per kw-hr. was largely due to the excellent load-factor resulting from water pumping.

On the other hand, a certain 60-kw gas-producer plant supplied its community of 700 population with 45,000 kw-hr. at a unit cost of about 5 cents per kw-hr. Here the $337 outlay for coal (at $6.75 per ton) represented only 15 per cent of the total cost, $2,239, after having added the $1,901 required for labor and other items. Another producer plant in a town of 1100, but supplying practically the same output as the foregoing example, showed a unit cost of 8.6 cents per kw-hr. Its fuel cost was but 23 per cent of the total expense of operation, indicating again that the low fuel expense of this type of plant is not to be taken too optimistically in estimating what the total cost of operation is likely to be.

Many of these old plants were in poor condition and most were so badly overloaded that in case of accident to a machine it was necessary to drop part of the load. For a total rating of 475 kw in the group of stations referred to later the maximum load reached 415 kw. Few were being operated at a profit, and for most of them no further funds were in sight for extensions and repairs. One station, for example, was acquired for a consideration of $1 and the assumption of the mortgage that hung over the property. The last remaining boiler of another plant blew up two days after the substation which replaced it had gone into commission. At the time of its failure the steam plant was being held in service only as an auxiliary while some final line changes were under way, but fortunately no damage or interruption resulted.

The effect of consolidation in improving load-factor conditions in even so small a group as three or four stations was also well exemplified when several plants near Lacon, Ill., were shut down and the load carried from the Lacon plant. Despite the similarity and proximity of the communities, the group load-factor at once rose to 35 per cent, which is fully 50 per cent higher than the average load-factors ordinarily found in individual towns the size of those in the group.

Some of the results of interconnected operation are per-

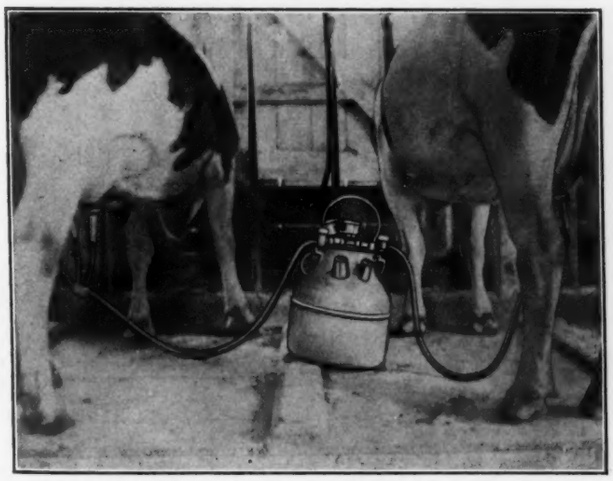


FIG. 27—ONE TYPE OF ELECTRIC MILKING MACHINE USED IN MODERN DAIRIES

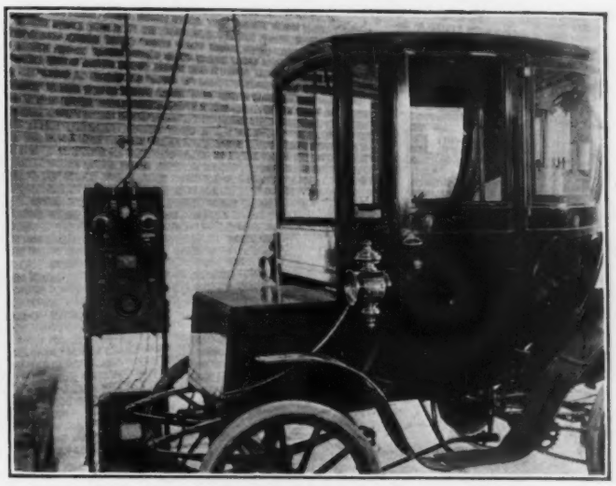


FIG. 28—ELECTRIC-VEHICLE EQUIPMENT ON A FARM 25 MILES FROM NEAREST PAVED STREET

haps best shown by the figures given in Table III, which are taken from the Lake County region north of Chicago. This territory in 1910 had seven separate steam generating stations serving as many communities. Electric service is now, however, available in twenty-one communities, the energy being generated in the Waukegan plant of the Public Service Company and distributed by two substations.

In the two-year period during which consolidation of the local properties was taking place it will be noted that while the population increased 50 per cent the number of new customers added was nearly 150 per cent. The maximum demand for all this additional connected load rose, however, barely 90 per cent, for, owing to diversity, the load-factor was nearly doubled. The consumption also more than tripled, indicating that the individual customers were using more service than before.

TABLE III—DATA ON INTERCONNECTED OPERATION

Year	Population	Customers	Maximum Kw	Load-Factor, per Cent	Kw-hr. at Local Stations	Kw-hr. at Waukegan	Cost of Coal	Tons Coal	Lb. Coal per Kw-hr. at Plant	Substation and Station Cost	Station Cost per Kw-hr., Cents	Cost of Coal per Kw-hr., Cents
1910.....	10,500	943	415	14.6	532,782	.....	$10,862	5,431	20.4	$29,087	5.46	2.04
1912.....	16,300	2,647	793	25.6	1,777,427	2,437,451	10,850	5,606	4.6	20,563	1.16	0.61

By a curious coincidence, the fuel cost of producing all this increased output was practically identical with the earlier fuel expense, although a dollar's worth of coal was now generating three or four times as much electricity as under the conditions of independent operation. Owing to purchasing advantage the coal was also bought at a lower price.

The fuel economies obtained by the small generating stations ranged from 16 lb. to 27 lb. of coal per kw-hr., the average for the seven plants being 20.4 lb. per unit, as noted. At the Waukegan station a generating efficiency of 4.6 lb. per kw-hr. is the rule, showing a saving in fuel cost of 1.43 cents per kw-hr. Nearly $9,000 per year was also saved in station costs. In operating expense combined operation thus saved the difference between 5.46 cents and 1.16 cents per kw-hr., or 4.30 cents per kw-hr.

The investment in the seven old stations, which had an aggregate rating of 475 kw, averaged $178 per kw. To shut these plants down and carry the same territory from the Waukegan generating station required an investment of $368 per kw, or more than double the former outlay. This investment was divided as follows: Transmission lines, 50 per cent; generating apparatus, 32 per cent; substation equipment, 18 per cent.

The investment for this centralized distribution has involved a fixed charge of $32,591 per year, or 1.83 cents per kw-hr. delivered. Adding to this capital charge the operating cost of 1.16 cents per kw-hr., the total present cost becomes 2.99 cents. The production cost under the former conditions was made up of the operating expense, 5.46 cents, plus 0.83 cent for the fixed charges, making 6.29 cents per kw-hr. The net saving of group operation, including consideration of the extra investment involved, has therefore been 3.30 cents per kw-hr. for the territory referred to.

Statistics and Officers

The Public Service Company of Northern Illinois is capitalized at $15,000,000. The recent report of the president showed a gross income of $4,230,021 for the fourteen months ended Dec. 31, 1912. Of this amount, $1,861,567 represented net earnings. As noted elsewhere in this article, the company serves nearly 150 communities with an aggregate population of 500,000. Its total connected load is 81,125 kw, of which 38,732 hp is in motors and 6100 kw in railway rotary converters. Its employees number 1500. For the year 1912 the company's income per connected kilowatt was $38, total, or $28 exclusive of street lighting. The yearly income per kilowatt per capita was similarly $7.50, or $5.50 not including street lighting.

FIG. 29—JOINT USE OF POLES

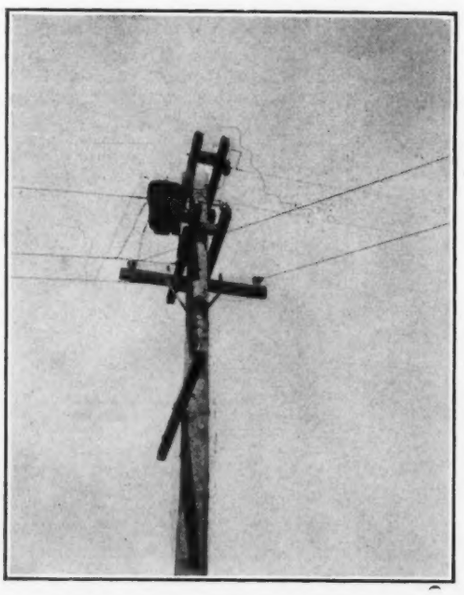


FIG. 30—VOLT BRANCH LINE FOR TWO FARM CUSTOMERS

The officers of the company are: President, Mr. Samuel Insull; vice-presidents, Messrs. Frank J. Baker and Charles A. Munroe; assistant to the president, Mr. John F. Gilchrist; secretary and treasurer, Mr. John H. Gulick. Mr. George H. Lukes is general superintendent, Mr. J. G. Learned is in charge of commercial development, and Mr. J. L. Hecht is mechanical engineer.

Commercial Development Under Group Control

Acquisition of new lighting and motor business by properties in northwestern Illinois following consolidation into system of the Illinois Northern Utilities Company

COMMERCIAL development of an interesting kind has followed on the heels of group administration of the score of electric properties in Northwestern Illinois composing the Illinois Northern Utilities Company's system. Within less than a year of consolidated operation and sales effort, a thousand houses have been wired and connected up for central-station service in this territory, while in the same period the additional industrial motor load contracted for has aggregated 2500 hp.

Apart from the other varied aspects of group operation which it illustrates, the case of the Illinois Northern Utilities Company has particularly shown the extent to which the lighting and power demands of an existing field can be increased by modern commercial methods. For here the specialized cultivation possible with a centrally organized and carefully directed, although not expensive, sales force has achieved results in intensifying local consumption far beyond anything ever accomplished under the former conditions of independent operation.

Public Confidence as an Asset

Nor will the local commercial department—modest as it has been successful—concede to itself all of the credit for the recent rapid development in a field supposed to have been already well worked. The department's own selling efforts, it asserts, have received incalculable support from the popular faith, met on all sides, that behind every proposition which the company offers there stands a great proved utility organization, officered by men who have already created substantial, successful businesses in the communities which for years they have faithfully served.

Such confidence on the part of the public, as the sales department is the first to admit, helps to close contracts and to sell service. And as an asset it is not to be overlooked when comparing the possibilities of a great interconnected electrical undertaking with the restricted operation of independent properties of limited resources and doubtful public favor.

The Illinois Northern Utilities Company now furnishes electricity and gas in a dozen counties in the northwest section of the State, reaching fifty communities scattered over an area of 4500 sq. miles. This territory was formerly served by nineteen separate utility companies, principal among which were the Oregon Power Company, Oregon, Ill.; the Lee County Lighting Company, Dixon, Ill.; the Belvidere Gas & Electric Company, Belvidere, Ill.; the Morrison Gas & Electric Company, Morrison, Ill.; the Mendota Light & Heat Company, Mendota, Ill., and the Plano Heat, Light & Power Company, Plano, Ill.

Among the 60,000 inhabitants of these fifty communities the Illinois Northern Utilities Company now serves 8000 electrical customers and about an equal number of gas consumers. Its connected electrical load at present aggregates 11,000 kw, of which 2500 kw is in industrial motors. Projected and in present operation the company's transmission system aggregates 250 miles of lines, of which 105 miles have already been built and are in use. Among the properties taken over are several district-heating plants, both steam and hot-water, as well as a combination ice factory which will ultimately be converted to motor drive.

In addition to the several utilities already mentioned, the Illinois Northern Utilities Company owns and operates the Sterling, Dixon & Eastern Electric Railway Company, whose trackage includes 12 miles of interurban railway and 6 miles of city street-car lines in Dixon and Sterling.

System and Generating Stations

The interconnected system of the Illinois Northern company centers about the group of water-power plants at Oregon, Dixon and Sterling which utilize low-head falls in the picturesque and scenic Rock River. These stations are at present tied together by a 13,200-volt transmission system, as shown by the map, these lines being a heritage of earlier operation. It is the intention later, however, to replace these lines with standard 33,000-volt construction which the company has adopted for its entire system.

At all three of the water-power points above named steam relay equipment is also installed as an auxiliary to the hydroelectric plants The water-power is employed for carrying the bulk of the load, the steam plants being swung in to aid chiefly during peak periods. Ultimately it will be the plan to erect a central steam station at Dixon, transmitting in all directions from that point. The initial equipment contemplated for this central plant will be rated at 2000 kw.

FIG. 1—DIXON DAM AND COMBINED WATER-POWER AND STEAM PLANT

At Dixon a massive concrete dam 300 ft. long creates a net available head of 7 ft. in the broad stream of

the Rock River. The seven Leffel and American waterwheels installed have a total rating of about 500 hp and are controlled by Woodward mechanical governors. Belted to the same counter-shaft are 175-hp and 150-hp Armington-Simons engine units. The electrical generating equipment includes a 500-kw double-current railway generator, a 300-kw General Electric alternator and a 200-kw Westinghouse

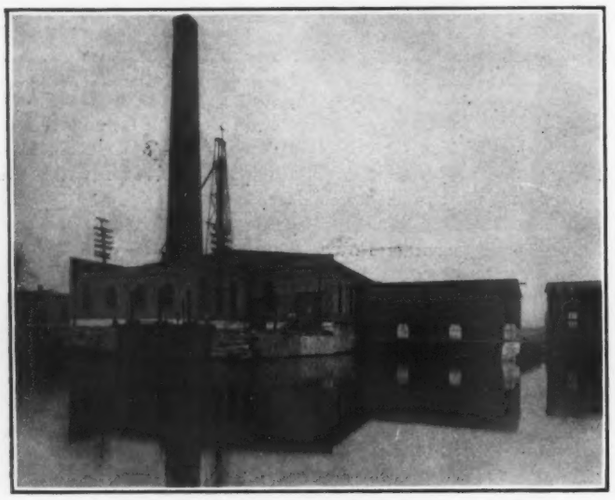


FIG. 2—COMBINATION STEAM AND WATER-POWER PLANT AT STERLING

alternator. The water-power section of the Dixon plant is a modern concrete, brick and steel structure. Here also are located the 13,200-volt transformers, lightning arresters, etc., for the transmission line connecting the Dixon station with the other points of the system.

At Sterling two generating plants are at present operated, one being a purely steam station while the other is a combination hydroelectric and steam plant. The water-power units in the downtown station comprise in all five Leffel and Stillwell-Pierce-Smithvale waterwheels, aggregating

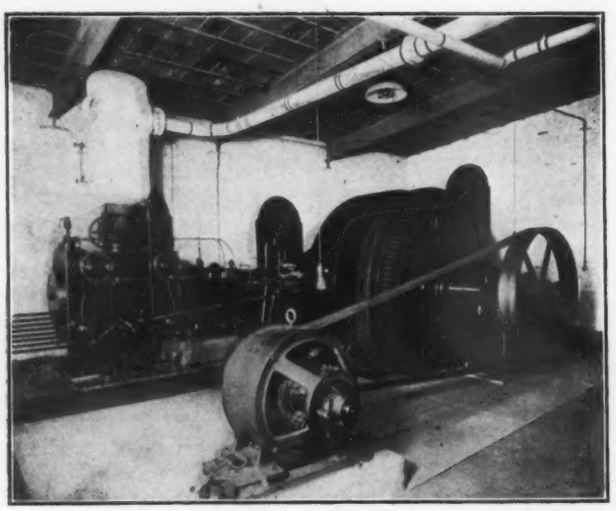


FIG. 3—DIRECT-CONNECTED ENGINE SET IN STERLING STEAM PLANT

about 300 hp in total rating. Supplementing these machines is a 250-hp Ames engine belted to the same shaft. The electrical equipment comprises a 300-kw Stanley alternator and a 200-kw Westinghouse double-current railway generator, which is motored during periods of varying railway demand to help drive the other machine. In addition to the interconnected units above mentioned, all of which are belted to a common shaft, there is also installed a 300-kw Westinghouse 1100-volt, 60-cycle, two-phase alternator, directly connected to a Ball-Corliss engine. A pair of Kewanee boilers and one Star Scotch marine unit make up the 400 hp in boiler capacity installed at the Sterling combination plant, which is located near the center of the city.

On Fourteenth Avenue, Sterling, the company also operates a 300-kw belted engine-driven unit in the plant building originally erected to house the generating station for the interurban railway now owned by the utilities company. This station is called upon only during lighting hours, to aid in time of system peaks.

The combination hydro-steam station at Oregon contains 300 kw in steam-driven units and 200 kw in waterwheels.

At Dixon there is stationed the "system operator" who dispatches the load for the several generating plants feeding into the Dixon-Sterling-Oregon system. This dispatcher orders units started up to meet varying load conditions and in general dictates the operation of the system. All switch openings are also reported to him by "hold" cards giving a full account of the interruption, similar to those used on the other Illinois interconnected systems. Another system operator dispatches the loads for the company's interconnected lines centering about Belvidere.

Isolated steam plants are at the present time still being

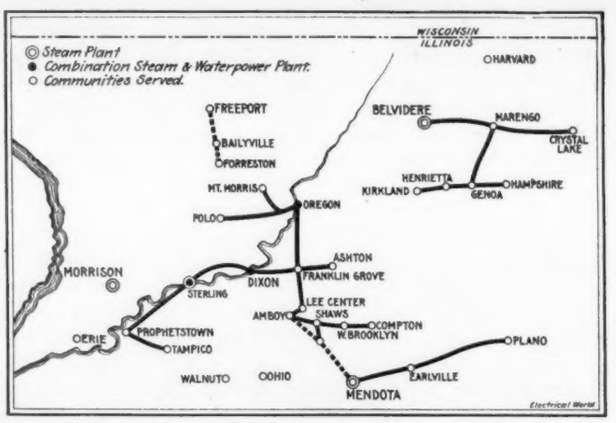


FIG. 4—SYSTEM OF ILLINOIS NORTHERN UTILITIES COMPANY

operated at Mendota, Walnut, Ohio, Morrison, Fulton and Erie pending the construction of transmission lines to reach these points.

District Organization

The plan of district organization which is followed in the other Illinois systems obtains also in the Illinois Northern company, whose territory is divided into lettered districts with headquarters as follows: B, De Kalb; C, Oregon; D, Dixon; E, Mendota; G, Geneseo; M, Morrison.

Each district is in charge of a district superintendent, to whose local staff are assigned salesmen, inspectors, etc., by the heads of departments located at the main office in Dixon. Operation of all plants and substations is in charge of the mechanical engineer of the company, whose own working organization is independent of the local superintendents' jurisdiction. The local inspectors, who have charge of lines, etc., compose the department of the electrical engineer of distribution.

Attractive sales offices are maintained at the district headquarters. Appliance exhibits attract attention to household electrical conveniences, and occasionally demonstrations of devices are given. It is the purpose to limit to the minimum, however, the stocks of equipment, supplies, etc., carried at the district offices. The company's large warehouse at Dixon is the principal distributing center for stocks of all kinds, supplies being shipped thence by freight to various points on the system. This problem of transpor-

tation of both material and men becomes extremely important in the case of a company operating among communities as remotely scattered as are those of the Illinois Northern system. A number of small light automobiles are maintained by the company for the use of its officials and superintendents in visiting the various properties. A dozen motorcycles are also in use by inspectors, trouble men, etc.

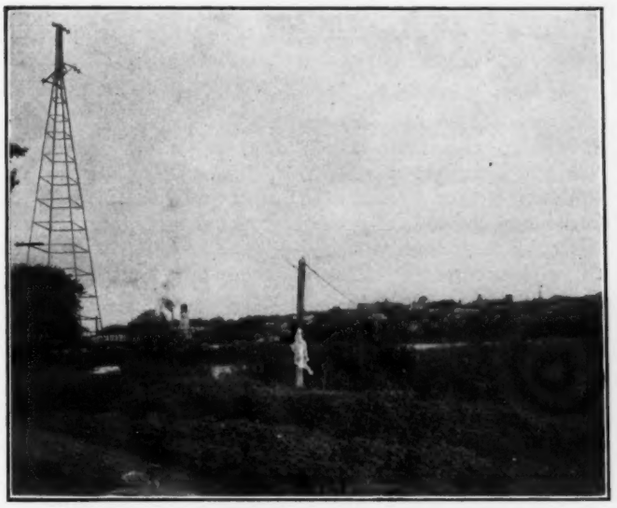


FIG. 5—STEEL-TOWER SPAN ACROSS THE ROCK RIVER AT DIXON, ILL.

For hauling supplies, construction material, etc., between the Dixon warehouse and the railroad stations, and for distributing both gas and electrical apparatus locally, the company has in service a 3000-lb. Walker balance-drive electric truck, illustrated herewith. This equipment effects considerable saving over the cost of team delivery for the same service and is also of benefit to the commercial department in impressing upon local manufacturers the merits and economies of electric-vehicle operation.

TRANSMISSION LINES AND SUBSTATIONS

For general transmission purposes 33,000 volts has been selected as the standard line pressure for the Illinois Northern system, although a number of miles of 13,200-volt construction is still being operated as originally acquired from the former owners. The transmission-line specifications for the Illinois Northern system in general resemble those of the Public Service Company of Northern Illinois, with which the Illinois Northern company has been closely identified in its administration.

For main trunk-line construction, especially along highways where secondary distributing circuits of low voltage are likely to be added later, the type A four-pin-arm construction is employed, with all conductors in a single plane. For 33,000-volt lines paralleling railroads and those in other locations where additional circuits are not likely to be run at a later time the double-arm type B construction is used, employing a pair of 4-ft. two-pin arms and carrying the ground wire on one of the upper pins. Provisions for grounding at every fifth pole, etc., are identical with those already described.

Nearly 250 miles of transmission lines are projected or in operation by the Illinois Northern company, and of this mileage 40 per cent is already in service. By the extension of the Mendota-Plano line it is planned to connect with the Public Service company's southern system at Yorkville, and with the completion of a line now being built from Marengo and Belvidere to Crystal Lake connection will also be established with the Public Service company's northern system, thus making for interconnected operation in the largest sense.

For stepping down from the transmission potentials of 33,000 volts and 13,200 volts to local distribution pressures, for which 2200 volts is standard, by far the largest proportion of the Illinois Northern company's substations are of the indoor type, some housed in former plant buildings. Several outdoor substations are, however, employed for supplying small communities.

Substations are located at Hampshire, Polo, Franklin Grove, Ashton, Lee Center, Amboy, Shaws, Compton, Sublette, Morrison, Fulton, Erie, Prophetstown, Tampico, Earlville, Piano, Kirkland, Genoa and Forreston.

In the smaller towns, where the total load, mainly lighting, does not exceed 50 kw to 75 kw, local distribution is chiefly effected by single-phase 2200-volt lines. In the cities where there is considerable demand for motor operation three-wire, three-phase distribution is employed. Such three-wire construction is regarded as preferable to four-wire circuits where the load does not exceed several hundred kilowatts and the distances involved are short—not greater than 2 or 3 miles.

RESIDENCE LIGHTING AND HOUSE WIRING

Organized only in July of last year, the commercial department of the Illinois Northern Utilities Company has lost no time in demonstrating the remarkable development possible in communities previously served with electricity, when attacked along aggressive business-getting lines with the aid of an up-to-date centralized sales organization. The results already shown in newly contracted and connected loads quite surpass the possibilities in the same towns under separate administration. Here, again, it appears that group operation makes for increased effectiveness and efficiency no less in the work of selling electricity than in the production and distribution of the energy.

In ten months the Illinois Northern company has acquired nearly 1400 new customers, 1000 of whom were residence users secured mostly under the twenty-four-months-to-pay house-wiring offer. At the present time such house-wiring contracts continue to come in at the rate of twenty-five a week. Local contractors receive the jobs, which for the knob-and-tube construction permitted in these outlying communities average $2 per outlet. The contractor is paid 95 per cent of the full amount on completion of his work, the company carrying the customer's account two years if desired. Although many take advantage of this two-year-to-pay offer, the majority are found to settle up the entire amount within a few months. In any event the retired farmers and other permanent classes of customers en-

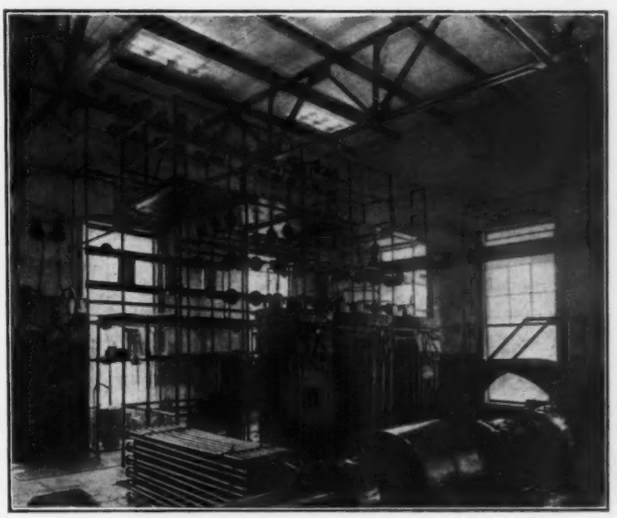


FIG. 6—TRANSFORMERS, LINE ENTRIES AND LIGHTNING ARRESTERS IN DIXON STATION

countered in these communities are thoroughly responsible, and bad debts are unknown. The local contractors are themselves active "boosters" of house-wiring business and take an interest in working up lists of "prospects" for the salesmen to "close" on the latter's weekly visits to these smaller outlying communities.

The company's standard rates for residence lighting are

FIG. 7—ORNAMENTAL MAGNETITE-ARC LIGHTING AT DIXON

14.5 cents for the first thirty hours' use of the maximum demand and 8 cents per kw-hr. thereafter. For prompt payment within ten days this schedule is subject to a discount of 1 cent per kw-hr., making the net cost 13.5 cents and 7 cents per kw-hr.

In addition to securing 1400 new customers and wiring nearly a thousand old houses, the commercial department in ten months has sold over $50,000 worth of merchandise, including about 900 electric irons and 250 toasters.

Street and Ornamental Lighting

Street illumination may be very properly termed the "backbone" of the lighting business in most of the smaller communities of the class reached by the Illinois Northern lines. Supplementing the regular street-lighting service, much valuable ornamental-lighting business has been obtained with the aid of the company's patrolled flat-rate schedule, reproduced herewith. The prices given in the table are on a weekly basis and are subject to a discount of 5 cents per lamp per week for payment within three days of date of bill rendered. The same schedule is also available for window-lighting and sign displays.

In furthering ornamental installations a most opportune time has been found to be that of renewing the regular street-lighting contracts. Some of the leading merchants are first tactfully approached and interested, if possible, in the matter of decorative post lighting. Then in their hands are left the details of promoting and carrying through a plan by which the local business houses defray the cost of installing the posts, the town agreeing to furnish energy to operate the lamps. The company offers every assistance, of course, tendering the use of its automobiles to take committees to inspect similar lighting installations in nearby towns, etc. But the actual carrying out of the plans is left in the hands of the self-appointed committee of progressive merchants. This plan has been extremely successful, valuable lighting business being acquired in this way without special direct sales effort.

In Forreston, for example, a ten-year contract was recently closed for $1,688 worth of street lighting per year, of which amount $860 covers the ornamental post lamps in the business district. The merchants defrayed the cost of the latter equipment, and the town furnishes the lighting service. Forreston is a town of 890 inhabitants, so that its street-lighting outlay per capita is nearly $2 per year.

At Amboy, a town of 1800, the company has contracted to furnish seventeen three-lamp post fixtures and sixty-eight street lamps, for which it receives $2,700 per year.

At Dixon 4-amp ornamental magnetite lamps of the inverted type are being erected on trolley-pole brackets. Fifty-one are to be eventually installed, the lamps being furnished by the merchants while the cost of operation and trimming, $47 per lamp per year, is defrayed by the city.

Industrial Motor Applications

In the ten-month period already referred to contracts have been closed for 2500 hp in motor load, although, owing to the rapid rate at which this business has been acquired, the company has been rather pressed to supply the increasing demand. For that reason not all of this new motor business contracted for is yet connected to the lines, although the present industrial motor load reaches a total of 3300 hp.

Among the large consumers with which contracts have been closed are the Independent Harvester Company, Plano, 600 hp; the National Silica Company, Oregon, 500 hp; the Chicago Stove & Range Company, Fulton, 125 hp; the Gossard Corset Company, 125 hp, and the Inderrueden Canning Company, Hampshire, 125 hp.

The 500-hp motor load of the National Silica Company, for example, is applied to grinding and reducing processes which continue uninterruptedly twenty-four hours a day and 365 days a year. This insures, of course, most desirable 100 per cent load-factor business for the central station.

A characteristic off-peak motor load found in many of the towns served by the Illinois Northern company is the operation of local gristmills. About fifteen of these mills are now operated by central-station energy, each such mill containing motors of 50-hp to 60-hp rating. This gristmill business is taken under a special off-peak contract by the terms of which the mill operator secures a net rate of 3.5 cents per kw-hr. provided he keeps off the lines from 4:30 p. m. to 10 p. m. during all twelve months of the year. During June, July, August and September the utilities company waives collection of the minimum monthly charge of 50 cents per hp connected.

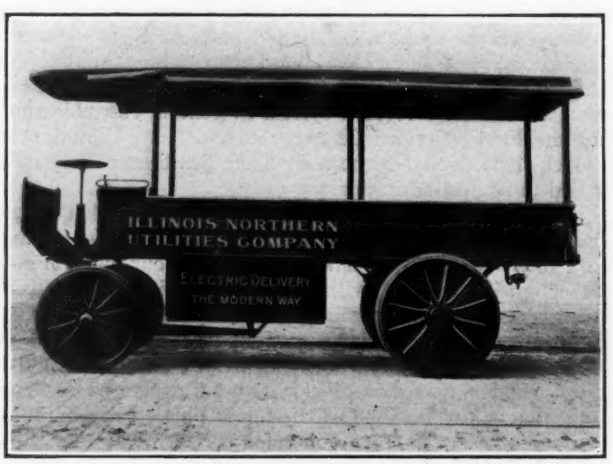


FIG. 8—ELECTRIC DELIVERY TRUCK IN COMPANY'S SERVICE AT DIXON

In serving these gristmill customers the company is automatically protected in the observance of its off-peak clause, because all the farmers who come to town to have grinding done invariably start home by 4:30 p. m. to get their evening milking done. This insures, of course, that the mills will be shut down in ample time to avoid the evening lighting peak.

Supplementing the yearly load characteristics of the gristmills comes the demand of the canning factory referred to. This plant is shut down during the winter and spring months when the milling business is at its height and, conversely, is operated at its own maximum output when the mills are running light. Here again is secured valuable seasonal diversity, of which advantage could hardly be taken without a transmission system covering a comparatively broad area and a group of communities.

TABLE OF RATES FOR PATROLLED FLAT-RATE SERVICE, ILLINOIS NORTHERN UTILITIES COMPANY

	WATTAGE OF LAMPS						
	5	25	40	60	100	150	250
Dusk to 10 P.M.—6 days..							
Dusk to 12 P.M.—1 day....	$0.080	$0.15	$0.17	$0.22	$0.32	$0.45	$0.70
Dusk to 11 P.M.—6 days..							
Dusk to 12 P.M.—1 day....	0.0825	0.16	0.19	0.25	0.38	0.50	0.80
Dusk to 12 P.M.—7 days..	0.0850	0.17	0.21	0.27	0.40	0.60	0.90
Dusk to 1 A.M.—7 days...	0.0900	0.18	0.23	0.30	0.45	0.70	1.05
Dusk to dawn—7 days..	0.1050	0.24	0.30	0.40	0.65	0.95	1.55

Water pumping for towns is another long-hour application in the direction of which a start has already been made by the acquisition of half a dozen pumping loads in as many of the communities which are served by the Utilities company's lines.

The operation of sand and gravel pits in the company's territory affords a long-day load which has a desirable season load-factor. These pits cannot be conveniently worked during freezing weather, so that their principal demand comes during the warmer months when the output for lighting is at its minimum. Ordinarily they are started up in April and continue ten to twelve hours a day until October.

OFFICERS

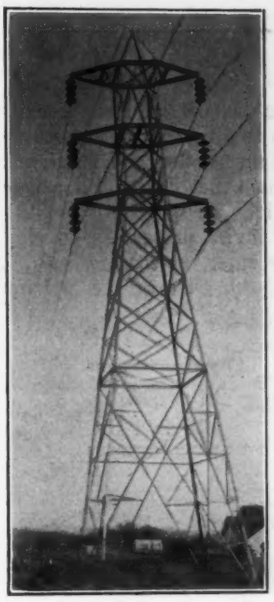
Mr. Samuel Insull is president of the Illinois Northern Utilities Company, Messrs. Frank J. Baker and C. A. Munroe are the vice-presidents, Mr. John H. Gulick is secretary-treasurer, and Mr. E. D. Alexander, as assistant to the president, has executive supervision of the company's operation.

FIG. 9—ELECTRICALLY OPERATED GRISTMILL

Mr. L. E. Marshall is general superintendent, Mr. J. E. Harlow is mechanical engineer, Mr. L. E. Jacobson is auditor, and Mr. C. B. Yonts fills the position of general contract agent.

Cost of Erecting 110,000-Volt Transmission Lines

One of the features of high-tension electric transmission has been the rapidity with which 110,000-volt tower work has been standardized. This is really amazing considering the number of 110,000-volt systems in existence and their relative newness, but is explainable by the fact that one is largely patterned after another, and that in many cases the engineers are recruited from the staffs of companies having 110,000-volt systems in successful operation.



TRANSMISSION TOWER

Herewith are given the labor costs on four different 110,000-volt lines in this country. All are six-wire, two-circuit tower lines on standard suspension insulators arranged on either side of standard Millikan towers spaced ten to the mile. None of the towers possesses concrete footings, but connecting the top of each in all cases is a Siemens-Martin stranded-steel ground wire. The costs included everything except general office expense and supervision, which should not exceed $50 a mile. Of course, the cost of the towers, insulators, wires and right-of-way is not included; neither is the cost of clearing the right-of-way. The figures given include wages, commissariat, team hire and transportation of material from the railroad to the right-of-way.

Line No. 1 passes through a high grade of country, necessitating more stub holes, angles and guying than Line No. 2, which passes through a wooded section most of the way. It will be noticed that the cost of distributing and stringing the wire in Line No. 1 is greater than in Lines 2, 3 and 4. This is due to the fact that only one three-phase line was operated at first, the other three-phase line having been strung afterward and while the first line was alive. In some of the more recent lines erected in this country, notably that of the Central Georgia Power Company, the insulators were attached to the towers before the latter were hoisted into position so that a saving in the fifth item, "hanging insulators," would be effected. All of the lines traverse fairly rolling country, dotted here and there with heavily wooded sections, and copper is used as a conductor for the most part, although sections of lines Nos. 3 and 4 are of aluminum. None of the lines parallels any railroad system for any distance, and the distribution cost has been approximately $5 a tower. Where concrete footings are provided for the towers, a practice which obtains in many transmission systems, the labor costs are considerably increased.

COST PER MILE OF ERECTING TWO-CIRCUIT, 110,000-VOLT TOWER LINES

Operation	Line No. 1, 49 Miles	Line No. 2, 34 Miles	Line No. 3, 129 Miles	Line No. 4, 181 Miles
Distributing towers.....	$47.16	$48.48	$49.15	$53.68
Assembling towers.....	92.66	101.23	94.79	98.06
Erecting towers.....	77.90	75.15	70.44	77.77
Digging stub holes.....	99.93	23.10	27.67	54.36
Hanging insulators.....	55.53	32.04	42.00	44.72
Distributing wire.....	48.84	17.21	27.20	30.84
Stringing wire.....	202.29	107.62	124.35	150.53
Digging holes for towers..	169.59	143.23	156.79	166.00
Total per mile.....	$793.90	$548.06	$592.39	$675.96

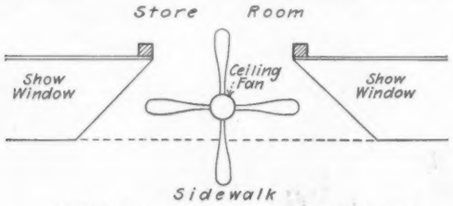
Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Electric Fans Versus Screen Doors

The progressive merchant who installs an electric ceiling fan in his doorway will keep the flies out of his storeroom without the nuisance of a screen door. Experience in several Southern cities has shown that flies will not pass through the draft of air created by such a fan. On the other hand, its cooling breezes invite passers-by to stop and look in the show windows or enter the store.

A screen door largely cuts off the view of the interior



CEILING FAN FOR KEEPING OUT FLIES

from the street. When arranged to be slammed shut by a spring it is a distressing noise maker. The fan, however, is quiet and inconspicuous, and it makes possible a clear doorway opening upon the street. Its effectiveness in keeping out flies was proved to one merchant whose store was across the street from a Greek restaurant which had been a rich breeding place for the insects. After being prevailed upon to substitute an electric fan for his screen door the visits of flies ceased altogether, although not a few hardy specimens had formerly ventured past the noisy screen door.

A "Wire Now" Campaign at Dayton

Seizing the opportunity when property owners are rehabilitating and redecorating their flood-stricken homes, the Dayton Power & Light Company is conducting a "Wire Now" campaign which is securing many new residence customers who otherwise would probably never have had their houses wired for electricity. The flood waters which stood for several days in the lower stories at Dayton have made refinishing and redecorating everywhere necessary, and while this rehabilitation is going on a large number of hitherto unwired buildings are being equipped for electric service. Every contractor in the city is crowded with work, in spite of the doubled forces which some are running. Since the flood a large amount of new power business has also been taken on by the company in addition to the many new lighting services connected.

To impress further this "Wire Now" idea on the minds of the public, Mr. T. F. Kelly, contract agent for the company, has arranged to equip the store front of each electrical contractor in the city with a two-line 136-lamp electric sign flashing the words "Wire Now." There will be ten of these displays, located in all parts of the city, so that, approaching the downtown section from any direction, one cannot fail to notice and heed the wiring message. These signs are furnished and operated under the company's regular patrol service, at a cost to the contractors of $5 per month, which amount barely covers, however, the energy used. The signs will be operated for six months, during which period it is expected most of the flood rehabilitation will have been completed.

A One-Day Sale That Added 1031 Kw in Irons; Cost 85 Cents per Kw Connected

By a one-day special-offer sale at St. Louis, May 13, the Union Electric Light & Power Company added 1875 electric irons to its local circuits, securing this 1031 kw of connected load at a total outlay of only 84.6 cents per kw, including all expenses for advertising, post cards, delivery of irons, etc. The annual energy consumption of these 1875 irons is estimated at 215,625 kw-hr.; hence this one-day campaign will bring the central-station company an increased revenue of $15,093.75 per year.

The irons were offered to customers at a special price of $2.95 for only one day, May 13. Each iron purchaser also received a small shirt-waist ironing board, as shown in the accompanying illustration. These boards cost approximately 30 cents each, manufactured in quantities. The expense

WINDOW DISPLAY DURING WEEK BEFORE SALE

of delivering irons and boards to customers was 12 cents each.

For two days preceding the sale quarter-page advertisements were run in the St. Louis newspapers announcing the event. Some 40,000 red placard "hangers" were also distributed about town to advertise the special offer. Return stamped post cards were then mailed to each of the company's 23,000 residence customers. Name and address were already entered on the return card by addressograph, and hence it was necessary for the customer merely to place his signature under the blank form and mail the card to reach the company's office not later than May 13. The amount for the iron, $2.95, was collectible with the customer's next monthly lighting bill. Of the total number of 23,000 cards mailed out, about 4.5 per cent were returned with signatures as orders for irons. On the day following the sale nearly 100 additional orders were received, but these had to be refused, as the announcement had distinctly limited the special offer to the single date.

Electric May Breakfast at Newton, Mass.

At a May breakfast given by churches at Newton, Mass., on May 10 for the benefit of the Newton Hospital Social Service electricity was extensively used in cooking through the gratuitous co-operation of the Edison Electric Illuminating Company of Boston and the Simplex Electric

Heating Company of Cambridge, Mass. At the Eliot Congregational Church, Newton, about 1000 persons breakfasted between 7 and 9 a. m., and at the First Unitarian Church, West Newton, about 800 partook of the bill of fare. At the Eliot Church the Edison company installed three large electric ovens, twelve chafing dishes for scrambled eggs, an 8-in. disk stove for water heating, six egg boilers and a hotel-size plate warmer, the total load being 18 kw. At the West Newton church were six large pancake griddles, two plate warmers and eight water cups for egg boiling, the connected and actual load being 20 kw. The apparatus was run at the full heat throughout the entire breakfast period and was distributed at convenient points in each vestry and wired directly from the local Edison distribution circuits without recording meters. The Simplex company furnished the appliances without cost, and the only delay occurred through the inability of the kitchen staff to wash dishes at the requisite speed to meet the demand for service. At the next breakfast arrangements will be made for the use of electric dish-washing equipment. The work was supervised by a superintendent and three expert assistants from the Edison company's department of standardizing and tests, and by three expert demonstrators, two of whom were provided by the Edison company and one by the Simplex company. Printed matter describing the various devices used was available to those asking for it, and the Edison company advertised the event two or three days before by inserting the words "Electric Breakfast Saturday" in a 22-ft. by 35-ft. flashing sign at the Newton station of the Boston & Albany Railroad.

Artificial Ice and Central-Station Service at Clifton Forge, Va.

The Virginia-Western Electric Company of Clifton Forge, Va., operates a steam-driven station at Clifton Forge, a hydroelectric station at Buena Vista and a hydroelectric station at Lexington, Va. The company was organized in October, 1912, with a capital of $300,000, at which time it took over the properties of the Clifton Forge Public Service Corporation, the Buena Vista Light & Power Company and the Rock Bridge Power Corporation of Lexington and Buena Vista. Besides conducting a central-station business in Clifton Forge the company manufactures ice and has a few buildings which are heated with live steam from its station. The latter are located close to the station and the heating business is not of great importance, the income from this source aggregating about $400 a year. The company also owns water-power sites on the Cowpasture River and also on the Jackson River, the former site being capable of yielding 1000 hp and the latter site 4000 hp. No work on either development has been started, and of the two sites that on the Jackson River will be the first to receive attention.

The equipment at Clifton Forge comprises two 450-hp water-tube boilers burning soft coal costing about $1.90 a ton in the bin; a 750-kw, three-phase, 60-cycle, 2300-volt General Electric turbo-generator, and a Worthington surface condenser outfit. Water for boiler-feed purposes is taken from a deep well and also from the city supply, while water for condensing purposes is pumped from Smith Creek, which flows past the station. A low dam is thrown across the creek so as to form a pond of water during low-water periods for condensing purposes. The main line of the Chesapeake & Ohio Railroad Company passes in front of the station and a siding affords excellent facilities for bringing the coal to the outside of the boiler room. An 11,000-volt transmission line has been recently installed over which energy is transmitted to Covington and a 2300-volt line transmits energy to Iron Gate. There is a 200-kva substation at Clifton Forge, where the voltage is stepped up for transmission, and another 200-kva station at Covington, 12 miles away, where the voltage is again reduced. Energy is sold in bulk to the Covington Light & Power Company on a meter basis, the meter being on the high-tension side of the transformers at Covington. Covington has a population of 6000. The equipment at Buena Vista consists of a 90-kw substation in the city and the hydroelectric development at Goose Neck, 4 miles south of the city, where two 200-kw, three-phase, 60-cycle, 6600-volt units are installed operating under a head of 16 ft. The development is on the South River, and one mile south of Lexington on the same river is a 200-kw hydroelectric station, the unit being wound for 2200 volts, at which pressure energy is transmitted to Lexington. The substation at Buena Vista is located in the old steam station formerly operated by the Buena Vista Light & Power Company, which has since been dismantled. The latter company owned the franchise for furnishing electrical energy for lighting purposes, while the franchise of the Rock Bridge Power Corporation permitted the company only to sell electrical energy in Buena Vista for motor service. The 6600-volt transmission line from the Goose Neck plant passes through the Buena Vista substation to Lexington, 13 miles away, where it is stepped down in potential and fed in the circuits with that coming from Lexington station. Under ordinary conditions the Lexington station is not run during the day, the load being carried at the Goose Neck station, and during low-water periods one unit in each station is operated.

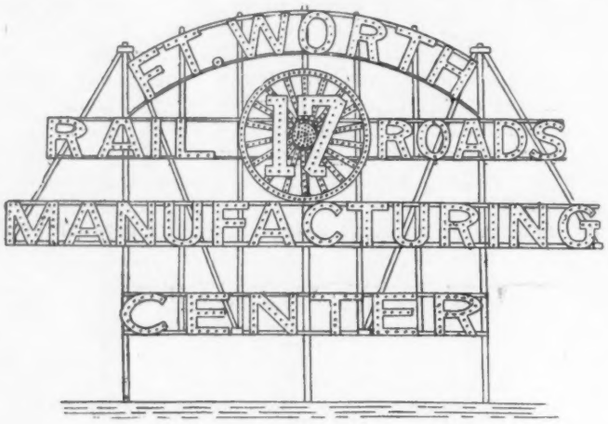
Ice-Making Business

The station at Clifton Forge contains in addition to the electrical apparatus two 25-ton Triumph ice machines, the units being steam-driven. During the winter months the output averages 10 tons a day, while during the summer the two machines are operated under full load together with a 15-ton York machine located in a separate ice-making station on Smith Creek, a short distance above the larger station. In the larger station the condensed steam from the turbine is used in making the ice, rendering it unnecessary to reboil the water so long as there is sufficient condensate for ice-making purposes. During the summer months, however, the condensate is not sufficient, so that reboiling of the extra water becomes necessary. The smaller ice-making station is not operated during the winter months.

The company has no competition from artificial ice in Clifton Forge and supplies through the Clifton Forge Ice & Bottling Company all of the ice used by the Chesapeake & Ohio Railroad Company for its passenger cars and refrigerator cars. The rest of its ice output is also handled by the Clifton Forge Ice & Bottling Works, a subsidiary company which retails it throughout the city. It will be understood, of course, that Clifton Forge, being in the mountains of Virginia, is not a winter resort, so that not much ice is required in the winter months. However, the company finds it expedient to keep its ice plant in operation in order that it may be in good condition when the heavy load of summer comes on. During the winter, therefore, the ice is sold at approximately $1.50 a ton to the retailing company, while in summer the product brings approximately $3.50 a ton. Storage is afforded in an adjoining building for 100 tons, which is sufficient to care for exceptional demands and to permit repairs on the machines when necessary. An electric crane with air hoist is used in handling the cans of ice, and usually one man on a twelve-hour shift can look after the cans and storage. In the operation of the station itself one engineer and one fireman, working on twelve-hour shifts, can take care of the electrical apparatus as well as the ice-making machines. While no actual figures of the revenue of the company are available for publication, the revenue from the ice business is said to be two-thirds the revenue received for the electrical energy generated in the steam station at Clifton Forge.

Electric Slogan Sign for Fort Worth

A new electric slogan sign was recently purchased by the Chamber of Commerce of Fort Worth, Tex. This sign is now being erected upon the roof of the Gamer Building, on East Front Street, overlooking the railroad yards at the Union Station, where it will be visible from all incoming and outgoing trains. The accompanying illustration shows this



ELECTRIC SLOGAN SIGN, FORT WORTH, TEX.

huge municipal advertisement as it will soon appear to travelers arriving at Fort Worth. The rim of the wheel will revolve while the spokes will be seen running toward the center of the wheel. This design was selected as being symbolic of the seventeen railroads running to one point.

This sign is to be one of the largest in the city, measuring over all 31 ft. in height and 45 ft. in length. Seven hundred red, green and white tungsten lamps rated at 5 watts and operating at a potential of 12 volts will be used in the sign. It has been stated by the contractors that the sign will be in operation within forty-five days from the date of signing the contract.

Maintenance of Dangerous Apparatus in the Streets

The Eastern Wisconsin Railway & Light Company maintained in the city of Fond du Lac an electric-light tower about 150 ft. high (built by and the property of the city), at the top of which was placed a cluster of lamps used for municipal lighting. On this tower of iron rods and piping and about 18 ft. from the ground was a platform readily accessible from the ground, and inside the tower there was an iron basket attached to a cable running over a pulley at the top of the tower. At the other end of the cable there was a heavy iron counterweight. In the basket there were three large paving stones used for ballast, so that the total weight of basket, ballast and occupant exceeded slightly that of the counterweight. The basket was used by the employees of the company to get to the lamp cluster for trimming purposes, and when not in use this basket had to be fastened to the platform to prevent it from rising by the action of the counterweight. This was accomplished by wrapping a chain around the basket rail and the platform rail and passing a hook at one end of it through one of the links. On June 2, 1911, while H. B. Harris was standing about 15 ft. from the tower and two small boys were playing on the platform the chain became unfastened and the basket shot upward, finally throwing out the stones when it had reached the top of the tower. One of these struck the man and inflicted fatal injuries. His widow sued for damages, charging negligence on the part of the lighting company. A verdict for the plaintiff in the lower court was sustained by the Supreme Court of Wisconsin (140 N. W. 288). Chief Justice Winslow in rendering his opinion said that if an electric light company to enable employees to attend to the lighting of a tower maintained in the street an unguarded hoisting apparatus, and if, while children were playing about, the basket in which employees rode, which had not been securely fastened, came loose and ascended rapidly, throwing out a stone which struck and killed a pedestrian, the company was liable, though it did not own the tower and though at long intervals a city official used the apparatus to inspect the tower.

Power Matters in Textile Mills

At the ninety-fourth annual meeting of the National Association of Cotton Manufacturers, held at Boston, Mass., lately, Mr. F. W. Dean, consulting engineer, presented a paper on power matters in textile mills. The author compared the advantages of steam engines and turbines for mill-plant service and emphasized the importance of using larger boilers, favoring the vertical or horizontal-return tubular type, on the ground that such boilers are cheaper to build, more easily cleaned and safer than water-tube boilers and of better permanent economy. The costs shown in Table I were given for various sizes of reciprocating engines and turbines, with condensing apparatus and exciters, all erected and including foundations, the capacities being at 80 per cent power-factor.

TABLE I—COST OF RECIPROCATING ENGINES AND TURBINES

Rating, Kw	Horizontal Four-Valve Engine	Horizontal Turbine	AREA OCCUPIED	
			Engine	Turbine
500	$22,700	$12,250	18 ft. x 26 ft.	14 ft. x 6 ft.
1000	40,200	17,900	24 ft. x 30 ft.	14 ft. x 8 ft.
1500	62,200	23,800	26 ft. x 35 ft.	19 ft. x 9 ft.
2000	76,400	30,500	28 ft. x 37 ft.	21 ft. x 9 ft.

The author also submitted Table II, showing the steam consumed per kilowatt-hour at 150 lb. pressure.

The point was emphasized that turbine-blade design and construction is now improving, so that the initial economies on such apparatus are maintained longer than formerly. The field of the low-pressure and the mixed-pressure turbine types was also outlined. Among the advantages of large boilers, say of 400-hp or 500-hp rating, are sustained safety conditions, slight gain in economy of operation, reduction of area, and decrease in steam piping, valves, blow-

TABLE II—STEAM CONSUMPTION

Rating, Kw	ENGINE		TURBINE
	Saturated Steam Guaranteed per Kw-hr., Lb.	Superheat 100 deg. Fahr. Guaranteed per Kw-hr.	Superheat 100 Deg. Fahr. Guaranteed per Kw-hr.
500	18.67	16.8	17.7
1000	18.8	16.9	18.
1500	18.8	16.9	16.8
2000	18.93	17.	16.6
	Vacuum 26 in.	Vacuum 26 in.	Vacuum 28 in.

off pipes, water columns, steam gages, brickwork and pipe covering. The author advocated the use of stronger draft and more rapid combustion, with the object of reducing the number of boilers and firemen required per mill. The paper closed with a discussion of the difficulties of central stations in meeting the costs of service for mills having steady loads and requiring a large amount of steam for exhaust heating.

Illumination and Wiring

Contrast in Illumination

By J. R. CRAVATH

Few realize how important a part contrast plays in all matters of illumination. By contrast as used in this article is meant the contrast between the surface brightness, or the illumination received by the eye, of various adjacent surfaces within the range of vision. For example, a bright lamp against a black background makes a very strong contrast. The same is true of a black letter on a white page. It is evident that the contrast produced by difference in surface brightness is an all-important element in seeing objects. In fact, objects are seen by virtue of two things, their difference in light-reflecting power and shadows. Of these two, shadows are probably the less important, and their importance is greatest when the light-reflecting powers of the different parts of an object are quite uniform. For example, a white statue uniformly illuminated from all directions and of uniform light-reflecting quality will have its features practically obliterated by the absence of shadows. On the other hand, shadows play no part in the illumination of a page of reading matter, as the letters are seen entirely by virtue of the difference that exists in the reflecting power of the black ink and that of the white page.

Contrast in the amount of light received by the eye from various surfaces is therefore an essential to vision; but there is another aspect of this subject of contrast to which the writer wishes to call attention in this article. This is the discomfort which may be caused by combining methods of illumination with wall colorings and furnishings in such a way as to cause strong and annoying contrasts. In considering the bad effects of exposed sources of light it is too frequently assumed, by those who have not given much thought to the matter, that a lamp of a certain type and candle-power exposed to the eye at a given distance is always equally objectionable independently of the surroundings. This is far from being the case, as must be evident when it is considered that a lamp which may cause one considerable conscious annoyance at night may be almost unnoticeable in broad daylight. Another simple experiment which will convince anyone that the contrast between a lamp and its surroundings has much to do with any discomfort caused by the glare from it can easily be made. When a lighted tungsten lamp is held against a white wall and a black cloth is drawn in back of the lamp the added discomfort caused by the black background will be very noticeable to anyone looking at the lamp.

More emphasis should be laid upon contrast and less upon absolute candle-power values than has been customary when attempting to predict what lighting arrangements will or will not give annoying glare. While it is undoubtedly true that the total candle-power of the lamp the light of which is shining in the eyes and the light flux entering the eye are important factors in producing annoying or detrimental glare, it must not be forgotten that no small part of the discomfort and eye strain caused by the glare from lamps under ordinary every-day conditions is due to contrast between the brightness of the lamp and its surroundings. I have even known cases where positive annoyance and discomfort were caused by strong contrasts in the colorings of walls and woodwork, where no lamps were exposed at all.

There are some very common instances of annoying contrast effect in connection with daylight in offices and homes. Nearly everyone has had experience with the extreme discomfort of sitting in a long, narrow office with a window at one end and attempting to converse with a man who is seated nearer the window. It is not the amount of light entering the eye in such a case that causes the annoyance, but the contrast between the bright sky, which is the source of light, and the much darker walls and suroundings inside of the office combined with the attempt to see the shaded side of a man's face against the light background. Such unpleasant effects are too often aggravated further by dark-colored walls and dark-colored window shades so pulled down that the daylight is received from a still narrower angle than if it were coming from the entire window. Both of these add to the darkness of the interior of the office and to the contrast which the eye experiences in passing from the window to the other office surroundings. Now, this same sky viewed from a darkened office room with discomfort would cause no discomfort if seen in the open with bright sky all around. On the same principle, a small kerosene lamp amid black surroundings outdoors on a dark night may be temporarily more uncomfortable to face than even a 250-watt tungsten lamp in a brilliantly lighter interior.

Another very convincing illustration of the effect of contrast in producing annoyance in connection with artificial illumination was accidentally given to the writer on a railroad day-coach. This coach was one which began its run on a branch line with oil lamps and was later switched onto a through route with electric lamps. On entering the car only two oil lamps were visible in front of the writer, and the contrast between these lamp flames and the surrounding dimly illuminated car was such as to make them very disagreeable to face. The car was equipped with a modern electric-lighting system consisting of a row of lamps in deep translucent reflectors over each row of seats. The reflectors were deep enough to cover the lamp reflectors except in the case of the two lamps nearest to the eye of any passenger. The electric lamps were suddenly turned on in addition to the oil lamps. The result, of course, was a large increase in the general illumination of the car and also a considerable increase in the flux of light entering the eye from lamps and reflectors. The general effect, however, was much more comfortable because the car as a whole was fairly well illuminated and there was not the annoying contrast between the lamps and surroundings that there was with only the oil lamps in use.

The reason for the discomfort caused by these contrasts is easy to find when one considers the mechanism of the eye. The muscles which govern the size of the pupil of the eye are always attempting to adjust the amount of light entering the eye to the amount the retina can comfortably use. Now, when such extreme contrasts are within the range of vision, it is impossible to reach any adjustment which is comfortable, and these muscles soon become very tired from their rapidly repeated spasmodic attempts to make an adjustment.

Experience shows that the retina of the eye can adapt itself to enormous changes in illumination and does so several times every twenty-four hours, but some little time is required for this adaptation, and in the meantime the amount of light is quickly adjusted by the pupil of the eye. From this it must be evident that, even though the surface brightness of lamps or surroundings may not be more than the retina would comfortably take care of under daylight conditions, yet there may be much muscular eye strain through the introduction of too great contrasts in surface brightness in the range of vision.

The practical application of these principles to comfortable lighting, both natural and artificial, should be considered by everyone, and most of all by those who engage more or less in illuminating engineering. In natural lighting window space should be made as large as possible and walls and ceilings should be finished in light colors to avoid the annoying contrasts described. For the same reason, dark window shades for shutting out sunlight are extremely objectionable, as light shades would result in much lessened contrast effects.

Consideration of the foregoing principles teaches that it is very diffcult and often impossible to produce comfortable

artificial lighting in rooms where the ceilings and walls are dark in color. In such rooms lighting entirely by indirect means is evidently impossible, and when one puts up any kind of direct lighting, even though lamps are concealed in globes of excellent diffusing qualities, there will still be such a decided contrast between the lamp globes and the surroundings as to make the arrangement more or less uncomfortable. Of course, one may use indirect lighting for displaying the ceiling and wall decorations and rely on direct localized lighting at certain points where more light is needed, but such a plan is obviously of limited application. In general, one cannot get away from the uncomfortable fact that the sources of light in a dark-colored room are also sources of discomfort if one is to sit facing them for any length of time. Fortunately such extremely dark interiors are rare. They have sometimes been treated with fair success by the use of lamps and reflectors recessed in the ceiling. Sometimes with a beamed ceiling construction it is possible to obtain the desired result in such a way that light shining in the eyes is not uncomfortable to the occupants of the room. A dark-colored room with low wall brackets usually affords as uncomfortable a method of lighting as one can find. The room is likely to be uncomfortable by daylight for the same reasons, unless one can sit with his back to the window.

The most comfortable conditions of artificial lighting in practice are likely to be found where violent contrasts of surface brightness within the ordinary range of vision have been eliminated. This does not, as some might infer, by any means necessitate or make advisable a uniform light color of walls, ceilings and floors and a system of indirect lighting which will uniformly illuminate these surfaces. It does mean, however, that one should seek to eliminate as far as possible sharp contrasts in the surface brightness in the adjacent parts of a room. To be specific, this means with artificial lighting that:

1. The light should come from as large an area as practical considerations will permit. With direct lighting this means that one should employ globes as large and as perfectly diffusing as possible and should not attempt to get too much light from any one lamp, but should subdivide the light sources as far as practicable.

2. Indirect lighting (or luminous-bowl indirect lighting with not over 15 per cent well-diffused direct light coming from the bowl) will reduce the annoying contrast effect below anything which can be obtained by means of direct lighting.

3. If indirect lighting is used, care should be taken to avoid decided contrast in the surface brightness of the ceiling immediately over the fixture and the more distant portions of the ceiling.

4. Sharp contrasts between a light-colored ceiling and dark-colored walls are undesirable in a large room where ceiling and walls come within the ordinary range of vision at the same time, though in small rooms they are less objectionable.

5. The practice of painting the lower part of the wall very dark with a sharp change to a light color from 4 ft. to 6 ft. from the floor is objectionable and should be modified to the extent of having less contrast. Under such circumstances if darker color is wanted along the lower part of the wall, a light green or reddish tint would be found better.

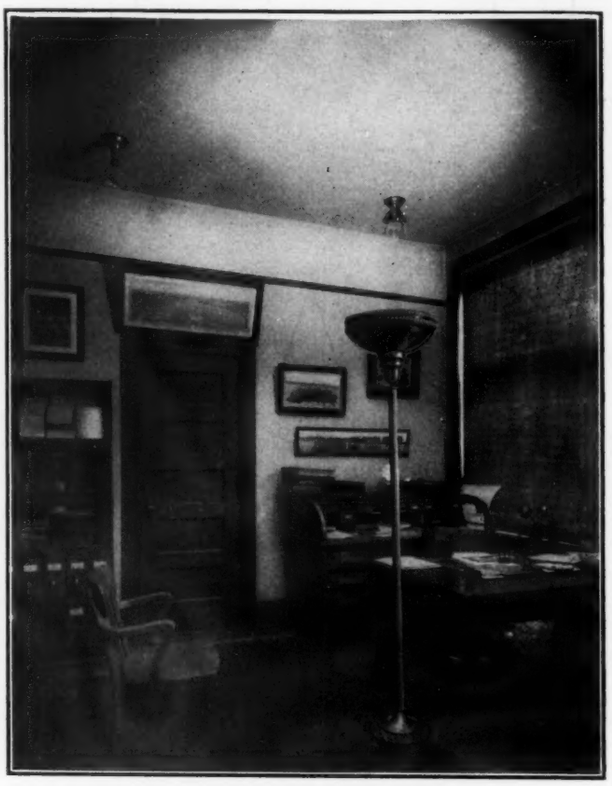
One should avoid purely local illumination by individual lamps amid dark surroundings.

Reduction of contrasts by the means indicated in the preceding paragraph will help to reduce the annoyance and eye strain caused by the glare or glitter from various papers which the occupants of the room may be reading or working over, and in homes and offices this is even more important than the increase in comfort due to a reduction in contrast between the various other light-giving surfaces in a room.

Portable Indirect-Lighting Fixture

The Union Electric Light & Power Company, St. Louis, has had made up and is offering for sale to its customers portable indirect-lighting fixtures of the type illustrated herewith, the design of which was suggested by Mr. A. C. Einstein, president of the company. With one of these standards any room can be quickly converted to the indirect scheme of illumination. While itself inconspicuous, the fixture avoids the use of reflector bowls suspended from and marring the ceiling.

This reflector standard measures 7 ft. to the rim of the bowl and has a 30-lb. weight in its 12-in. base, assuring a stable setting. The mirrored bowl contains four 100-watt



PORTABLE INDIRECT-LIGHTING FIXTURE

lamps. Base, standard and bowl are attractively finished in brass. The fixture is sold for $22.50 without the lamps, which cost about $3 additional. Our photograph was taken by the light from the indirect unit alone, illustrating the diffusion obtained.

Control of Electric Street Lamps in Kansas City, Mo.

A uniform system of street-lighting fixtures is being installed along several of the outlying business streets in Kansas City, Mo., by the Kansas City Electric Light Company. At present 102 fixtures of the four-arm-bracket type are being installed, and eventually all of the old vertical twin-bracket type will be replaced. On the streets where there are car tracks the fixtures will be placed on the posts supporting the span wires. The fixtures will be staggered along the streets, forty being used per mile.

Three wires strung along the top of the posts will be used to supply energy for the lamps. Where there is interference from overhead construction underground conduit will be used between poles. The energy will be transmitted to the different districts at 2200 volts single-phase and the emf will be stepped down to 220 and 110 volts for the distribution of energy over a three-wire, single-phase system. A 3 per cent drop in voltage was assumed in arriving at the

size of the territory supplied by each 220-110-volt circuit. The circuits are tied together where practicable so as to obtain as nearly uniform voltage as possible over the entire system.

The method employed for supplying electricity to the four lamps on each fixture so that one lamp may be operated all night and the advantages of a three-wire system when all of the lamps are lighted still be retained is interesting. At the 2200-volt distributing board in the central station are a double-pole oil switch and a single-pole oil switch connected as shown in the diagram. Up to midnight both of these switches will be closed; after that time the single-pole switch is opened, thereby leaving a single night lamp in service until sunrise.

Two single-phase transformers are used for each section and are connected as shown in the diagram. One transformer furnishes the energy for the lamps which are lighted till midnight (with the exception of the all-night lamp);

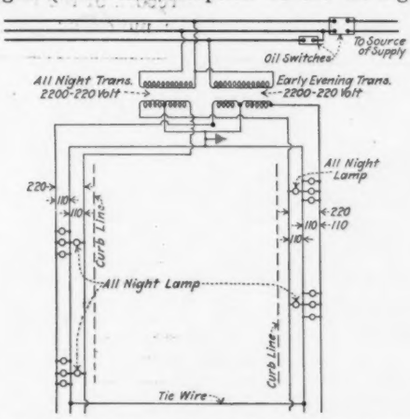


DIAGRAM OF CONNECTIONS FOR STREET LIGHTING

the other transformer furnishes energy for the all-night lamp only. A wire connects the middle of each secondary and is grounded in addition to being connected to one of the lines running along the top of each pole. By connecting the outer wires to the transformers as shown, 220 volts is maintained across them and the advantages of a three-wire system are thus obtained. The middle wires on each side of the street are tied together where practicable.

Recent Telephone Patents

Mr. F. Gottschalk, of New York City, has obtained patents for three transmitters. In all of these the internal parts are sealed so that they may be waterproof. This is accomplished by the use of gaskets at all joints. In one of the three inventions the diaphragm is made of cold rolled or tempered steel to give greater efficiency. Behind the diaphragm a very narrow air space occupies the space not taken by a receptacle for the microphone button of the usual granular type. The diaphragm is secured at many points of its periphery and in lieu of the usual mouthpiece a perforated metal plate is arranged in front of the diaphragm. In the second of these transmitters the diaphragm is mounted between two rings. One ring is internally threaded and a circular block engages these threads. This block has a circular knife edge which bears down upon the diaphragm to strain it radially. This block also carries the transmitter button and a claw-shaped member to engage the diaphragm at several points near its middle.

The third transmitter carries a clamping screw for adjustment purposes which, although accessible from the outside, is protected from moisture. The screw is made headless and occupies but a small part of the hole in which it is threaded. It is then protected by inserting an ordinary machine screw with a rubber washer to seal the joint between screw head and body piece.

Letter to the Editors

To the Editors of the Electrical World:

SIRS:—The respective fields of the gasoline and the electric truck, which are fairly well defined to-day for general transportation service, overlap somewhat in their application to fire department operations. The city of Springfield, Mass., which has probably a more extensive electrically driven fire-fighting equipment than any other town in America, has a mixed equipment of gasoline and electric machines. Local competition was strong in this case, a noted manufactory of gasoline outfits being situated in the city, and in the interests of a fair and open trial of motor-driven apparatus it was natural that the gasoline equipment should be utilized no less than the vehicle operated by means of electrical energy.

The success which has attended the use of electrically operated fire apparatus, not only in the above installation but in Germany, renders it profitable to look into the matter in relation to that future competition which is bound to arise all over the country as soon as the passing of the picturesque but costly horse is seen to be inevitable. In this class of service first cost is a minor consideration, but even here the facility with which electric tractors can be applied to ladder trucks, hose wagons and other existing apparatus in good condition is very striking. The electric vehicle has little to fear on the score of expense of adaptation, and the saving of much good material from the second-hand market or the scrap heap is a strong point in its favor. Then, too, the far greater simplicity of the electrically driven machine is of much importance in a service where reliability must be had. There is not much hazard in predicting that the cost of repairs and the percentage of stoppages due to hard service over rough pavements will favor the electric vehicle if comparative figures are secured on a scientific basis. On the score of acceleration the electric motor can distance any reciprocating engine. This means that a lower maximum speed can be safely had without loss of time on runs of moderate length, and every mile per hour saved on the maximum speed of motor trucks on city streets means increased safety to the public and decreased repair bills and depreciation. As an additional advantage it may be cited that the electrically operated apparatus can equal or surpass its gasoline competitor in mobility in crowded alleys and narrow streets—a consideration of no small importance.

The load which electrically driven fire-fighting apparatus offers to central stations is rather small in comparison with that of vehicles in daily and extended service, but it is business worth having none the less, and in many cases it can be handled at hours when a large part of the station equipment is idle.

Central-station men are sure to have to face the competition of the gasoline truck for fire department work, and it is well to be ready for the "showdown" and prepared to see that electricity has a fair trial in this important field. There is no reason why a large part of the fire department service should not be rendered by electricity. Possibly the outer suburban service, which may involve occasional long runs into the country, may necessitate harder work to win the day over the gasoline machine, but with present mileage and battery capacities the situation looks good for the electric vehicle if central-station men rise to the occasion. The complete motorization of city fire departments cannot be delayed much longer, and the central station should cast the weight of its influence in favor of a trial of electricity. For this service the horse is doomed, and whether or not electricity receives its proper appreciation depends not a little upon the favorable and energetic action of the local central-station man in co-operation with the vehicle manufacturers.

Springfield, Mass. J. G. RUSSELL.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Convenient System of Motor Maintenance and Repair Record Cards

In its plant at Lorain, Ohio, the American Ship Building Company makes use of a convenient and effective system of record cards in keeping track of the maintenance and repairs of the large number of motors it has in service. All these machines are of the 230-volt direct-current type. For each motor three data cards are employed for record purposes—a motor card, an armature card and a controlling-apparatus card.

As shown by the form itself reproduced herewith (Fig. 1), the "motor card" contains data concerning the frame, fields, journals and brushes. At a glance all the essential facts relating to this 7.5-hp motor driving a punch are thus available, including even such minute details as the size and number of turns in the series and shunt field windings. Blanks for the entry of catalog numbers, for example, prove especially useful when parts are needed in a hurry. Special attention is called, however, to the last item next to "remarks," where by cross-references there are given the numbers of all other duplicate motors about the shops, so that in emergency similar machines can be located quickly to be substituted if necessary.

The "armature card" (yellow) covers all winding, shaft and commutator data, and, in addition to a description of the motor to which this particular armature belongs, includes a list of the various other motors around the plant with which it can be used. On the back of the armature card, which is reproduced in Fig. 4, the blank space can be utilized for indorsements detailing the previous history of the armature. This particular card carried the following notations: Motor No. 32—3-19-10. Repair slip No. 678—7-30-12. Motor No. 76—10-12-12.

The American Ship Building Co. ELECTRIC DEPT.

MOTOR NO. 76

Operating: Horz. Punch ..... Location: Boiler Shop

Make: Westinghouse .... Type: "S" ... (Shunt-Open / Series-Enclosed / Compd. Semi-Enclosed)

Rated H. P. 7-1/2. Rated Speed 975 .... Actual Speed 1075

Frame No. 3 ..... Field Serial 666524

BRUSHES

No. 4 ..... Width 1-1/2 .. Thickness .. 3/8 .. Length 2-1/4 ..

SERIES FIELD Cat. No. 38710		SHUNT FIELDS Cat. No. 38709
#7/144 sq.	Weight of wire	
	Size of wire	#21/ .0285
17-1/2	No. of turns	2400 total
	No. of layers	

Winding remarks .....

Journals 2 ... Cat. No. ..... Com. End 30602 Pulley End 30602

Nos. of duplicate motors 18-19-25-32-35-34-38-39-40-44-45-72-75-76

Remarks .....

Form B-... 20

THE AMERICAN SHIP BUILDING CO. ELECTRIC DEPT.

REPAIR SLIP NO. 678

Date, 7/30 1912

Description of Apparatus ..... Armature #566544

West. S-3 7-1/2 H.P.

Taken from ... Motor #32 Mohn #6

#2 Punch Shop By ... Weigand

Probable cause of breakdown ... Commutator shorted

4 coils burned

Details of repairs made ... Put in 4 new coils and

20 Com. Segments, Straightened shaft

Re-banded and Com. turned

LABOR DATE	CK No.	HRS.	MATERIAL	
8-5	262	4	4	Coils
8-7	124	2	1#	Tape
8-8	124	4	1#	Solder
8-12	84	10	1#	.032 Mica Plate
8-13	87	2	2	Oz. .035 Fuller board
8-13	84	10	20	Mars
8-13	52	3		

Cost labor $ 9.78 Cost material $ 2.76 Total cost $ 12.54

Repairs completed 8/14 ..... Inspected by ... Hieman

Put in service ... 10/12/12 in motor #76

Form B-... 1000

FIGS. 1 AND 2—MOTOR CARD AND REPAIR SLIP

From this record the superintendent understands that the armature was put in motor No. 32 on March 10, 1910, and ran until July 30. It was then taken to the shop for repairs, as detailed on repair slip No. 678, and on Oct. 12, 1912, was put in motor No. 76. The "apparatus card" (reproduced in Fig. 5), which is printed on red cardboard, records miscellaneous information concerning the controller or starting box used with the motor, details of the resistor grids, circuit-breakers, brake, pulley, pinion, etc.

When any motor or part is sent to the shop for repairs a serially numbered repair card like that shown in Fig. 2 is made out, and on this is kept a record of the repairs made. Following the description of the motor or part, there is given a statement of the trouble and its probable cause, and the repairs necessary. In the columns below space is provided for entering up the labor required, noting the dates, number of workman's check and hours engaged. Parallel-

MOTOR REPAIRS FOR THE MONTH ENDING ....191..

Make	Type	HP	No in Service	No. repaired			Cost of repairs			Average cost	
				Armature	Fields	Miss	Armature	Fields	Miss	Per Motor	Per H.P.

FIG. 3—MONTHLY RECORD SHEET FOR MOTOR REPAIRS

ing this is an itemized enumeration of the material used, with an estimate of its cost. Adding to material expense the cost of the labor, the total outlay for the job is obtained. The repair card record closes with a memo by the inspector

and a final statement concerning the disposition made of the finished job.

Each month the repair-slip records are condensed on a sheet having headings as shown in Fig. 3, from which comparisons can be made of the relative repair costs of different types and makes of motors. Mr. A. B. Walton is electrical superintendent for the American Ship Building Company.

The American Ship Building Co. ELECTRIC DEPT.

ARMATURE No. 566544

Make Westinghouse Type B-3

Rated H. P. 7-1/2 Rated Speed 975 R. P. M. 1075

Winding Diagram No. 10 Dimension sheet No. 52

WINDING

No. of slots 49 No. of coils in slot 2

No. of wires in coil 8 No. of turns to coil 2

Size wire #15/ .0571 Length to coil

Total weight of wire

Throw of coils 1-12 Throw of leads 1-50

Cat. No. of coils 33028 Coil form No. 32 A. S. B.

Remarks

COM. END	SHAFT	PULLEY END
1-3/4"	Dia. bearings	1-3/4"
	Dia. Pinion or brake	1-5/8"
	Key way	3/8" x 1/8"

COMMUTATOR Cat. No.

No. of bars 97 Length 2 Width 3/16 Length risers

This armature can be used in motors

No. 18 39 40 19 44 45 25 48 32 73 35 74 34 76 38

Remarks

The American Ship Building Co. ELECTRIC DEPT.

CONTROLLING APPARATUS, ETC.

MOTOR No. 76

Make Cutler-Hammer Type Controller / Starting Box

Makers No.

A. S. B. Co. No. 76 Rating 7-1/2 H.P.

220- 250 volts

GRID		RESISTANCE		WIRE	
NO.	CAT. NO.	MATERIAL	SIZE	KIND	REMARKS

Wire on release magnet Size #21 Turns 28 Layers 14

CIRCUIT BREAKERS

A. S. B. Co. No. 76

Make G. E. Type "B" Rating 35 Amp

Serial No. 9306- 9307 Size carbons 7/8 x 1

AMPERES	ADJUSTED	DATE	BY

BRAKE

Make Type Shunt / Series

Makers No. A. S. B. No.

No. of rotating discs

No. of stationary discs

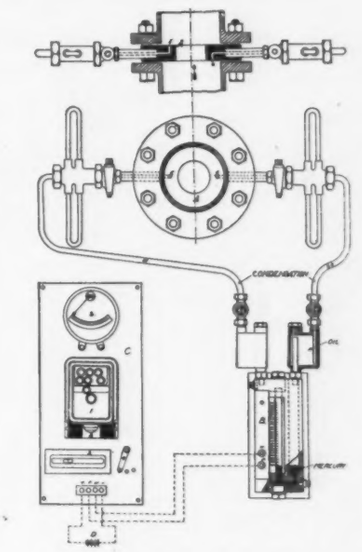
Bore of hub

Key way

COIL: Size wire Turns Layers

	PULLEY: Wood / Iron	Flange / Cone	Split	PINION: Brass / Iron	Steel / Rawhide
Bore					
Dia.				No. Teeth 23	Pitch 4
Face				Dia. 6-1/4"	
Keyway		X		Width 7/8"	
				Keyway 3/8 x	1/8

FIGS. 4 AND 5—ARMATURE CARD AND CONTROLLING APPARATUS CARD



STEAM-FLOW METER

A New Integrating Steam-Flow Meter

A type of steam-flow meter which has been used very extensively in Germany—although only three or four have been brought to this country—is the Hallwachs steam meter, illustrated herewith, employing the principle of the Pitot or differential-pressure tube. In the Hallwachs meter a mercury column is used as the measuring device, short-circuiting successive sections of known resistance, so that a quantity indication of the steam flowing can be read from the integrating ampere-hour meter which forms a part of the apparatus. One of these meters has been under observation and test during the past year by the Illinois Maintenance Company, Chicago, and has been found to compare in accuracy with other instruments of similar type.

As the drawing shows, a disk or ring, with a bore somewhat smaller than the diameter of the pipe through which the steam to be metered is passing, is inserted between two pipe flanges in a clear run of vertical or horizontal piping. The diameter of the opening in this disk is carefully computed from data based on the maximum flow of steam, pressure of steam, and whether steam is to be used for engines, giving a fluctuation in the flow, or for steam heating, where the flow is more constant. The openings in this disk are piped to the differential manometer, which is filled with mercury up to a certain point. The height of the mercury levels in this manometer at any instant will be in proportion to the square of the velocity of the steam when passing through the openings in the disk.

In one leg of the differential manometer platinum wires are fused into the glass at certain intervals, and when the velocity of the steam increases, the mercury is forced upward, making successive contacts with these platinum points. The platinum points are connected by small resistor coils of known dimensions. As the mercury rises, these circuits are completed and a current furnished from a 12-volt storage battery (capacity 30 amp) flows through and actuates a small integrating ammeter of special construction. This integrating ammeter is so designed that its reading, when multiplied by a constant depending on the pressure of the steam, will give the number of pounds of steam that have passed through the meter. These constants are determined by calculations based on the formula for the flow of steam through an orifice.

When proper care is taken of this meter there seems to be no reason why it should not meet the requirements, said Mr. S. M. Bushnell, of the Chicago company, in reporting on the subject before the National District Heating Association. The meter is fairly easy to install and requires very little attention except for recharging the storage battery. The principal objection to the meter is, however, that particular pains must be taken when turning steam through it. If steam is turned on suddenly, the mercury column will be lifted out of the manometer, necessitating refilling. This can be overcome by providing a by-pass across the two terminals of the manometer so that if it is necessary to turn steam suddenly on the pipe line, the pressure will equalize through this by-pass until the steam has attained its normal velocity, after which the by-pass valve may be closed. It should be noted, however, that this means careful attention on the part of the engineer and makes it desirable for the engineer for the company selling the steam to turn it on and off for the customer.

Proper Location for Synchronous Motors

Where should a synchronous motor be installed for power-factor correction, in the power house or in some large industrial plant? T. P.

To obtain the maximum benefit, the synchronous motor should be installed outside of the station, preferably at the end of the line. If installed in the power house, it benefits only the generating apparatus, which at times is sufficient justification to warrant its installation. When installed at the end of the line, it will render possible the use of less copper, smaller switches and smaller transformers to carry the same load carried heretofore at lower power-factor.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Noiseless Operation of Electric Machines.—G. Pontecorvo.—The author points out the importance of noiseless operation of electric motors in private houses, office buildings, etc., and the difficulties which are encountered in this respect, especially in the United States. The Westinghouse Electric Manufacturing Company, Pittsburgh, has a special noiseless testing room in order to study machines with respect to production of noise. The author distinguishes three different noises. The first is the "magnetic noise" due to the oscillations of the magnetic circuit. These oscillations are produced by a field of very high frequency and act in a radial direction, that is, perpendicular to the axle of the machine. These noises are very troublesome and generally very shrill. It is difficult to prevent them and to know in advance of building a machine where such noises will occur. In one case an induction motor produced a noise of such a high pitch that it could be heard above the noises of a very noisy factory. This motor was a 75-hp, three-phase, 60-cycle machine, with eight poles, running at 900 r.p.m. It had 108 open slots on the primary and 96 on the secondary and an armature diameter of 420 mm. The magnetic noise is practically the same at full load and at no load. This distinguishes it from the second type of noise, which is called "load noise" and is due to a lack of electrical or mechanical symmetry. It is generally of a lower pitch than the magnetic noise. It increases with the load and is often zero at no load. The third kind of noise is the "ventilation noise." There are two types of this. In one the noise is produced by the large quantities of air which are set into motion by the rotating parts of the machine and which are pressed out of the frame with great speed. This noise is of low pitch and in general endurable. It is more often found now since there is a tendency to improve the ventilation of electric machines. Another type of the ventilation noise is that found with induction motors, especially those with squirrel-cage armature, when they are operated with a high peripheral speed. The noise is here produced by the air blown from the rods at both sides of the armature through the field coils or from the armature into the ventilation channels of the field structure. It is a whistling noise of high pitch and very disagreeable. While it is similar to the magnetic noise, it can be distinguished from it by suddenly disconnecting the circuit while the motor is running. These "ventilation noises" can be obviated with comparative ease by simple mechanical means. To avoid the "load noise" perfect mechanical and electrical symmetry must be obtained. Several illustrative examples are given of what perfect symmetry means. The magnetic noise is most difficult to obviate. It depends on the frequency, and with the same induction, the same number of poles, etc., a 60-cycle machine will make more magnetic noise than a 25-cycle machine. The field intensity should be held rather low in machines which are to be noiseless. An induction of 12,500 in the teeth is to be considered as high. Alternating-current motors, as well as direct-current motors, should have a very large number of slots; less than three slots per pole and phase should not be used either in the armature or in the field structure. A table is given for the design of a certain motor with different numbers of primary and secondary slots, indicating what kinds of noises are to be expected with the different designs. Magnetic wedges closing open slots are often a good remedy. For direct-current machines a special form of the pole shoes is recommended.—*Elek. Zeit.*, May 15, 1913.

Formation of Deposits in Oil-Cooled Transformers.—A. C. Michie.—A paper, in abstract, read before the New Castle Section of the (British) Institution of Electrical Engineers. The "sludging" of transformer oil is dealt with and various tests and theories are described. The conclusion arrived at is that it is an oxidation process. Apart from the question of the quality of the oil, the design of the transformer has to be considered, and in this connection, if the formation of deposits is to be avoided or minimized, the following conditions should be avoided: overheating, undue access of air to the oil, conditions likely to give rise to the formation of ozone, contact of the oil with clean surfaces of copper, iron and lead.—London *Electrician*, May 16, 1913.

Lamps and Lighting

Tungsten Lamp with Downward Uniform Light Distribution.—An illustrated description of the new "Wotan focus lamp" in which the consumption per mean lower hemispherical candle-power is 1 watt per hefner candle. Reference is first made to the arrangement of the filament in a plane in zigzag form shown in Fig. 1. This method has been used in tantalum lamps, but with this arrangement the

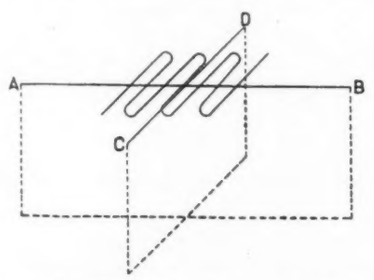


FIG. 1—ARRANGEMENT OF FILAMENT

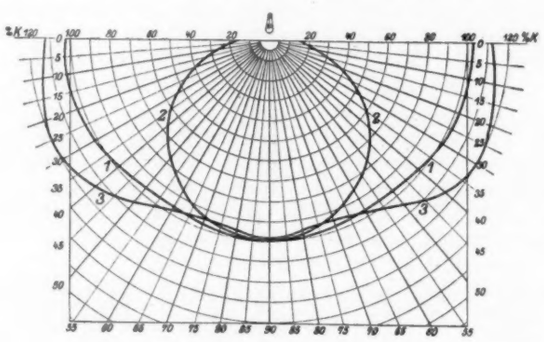


FIG. 2—LIGHT DISTRIBUTION CURVE

distribution of light is far from uniform. The distribution of light in the plane *AB* of Fig. 1 is shown in curve 1 of Fig. 2, and the distribution of light in the plane *CD* of Fig. 1 is shown in curve 2 of Fig. 2. This shows that with the filament arrangement in a plane the distribution of light varies greatly in different directions. In the new lamp, in which it is made more uniform, as shown in curve 3 of

Fig. 2, the filament is arranged in conical form and the part of the globe near the socket is used as a white reflector. —*Elek. Zeit.*, May 15, 1913.

Squirted Tungsten Filament.—A note on a recent British patent (No. 11,455, 1912) of J. A. Scoular and Dick, Kerr & Company. Viscous sodium silicate solution is used as a binding agent. The intimate mixture is calendered, squirted and dried. The raw filaments so formed are baked in an inert atmosphere and sintered in one operation in an electric resistance furnace.—London *Elec. Eng'ing*, May 15, 1913.

Drawing Tungsten Filaments.—A note on a recent British patent (No. 11,439, 1912) of the Deutsche Gasglühlicht company. During the process of hot-drawing tungsten filaments the heated wire is passed through dehydrated acids or their salts, which are viscous at the temperature of the wire as it enters the die. The use of boric and phosphoric acids is claimed.—London *Elec. Eng'ing*, May 15, 1913.

Street Lighting.—A. P. TROTTER.—His long reply to the extended discussion of his recent paper on standard clauses for inclusion in a specification of street lighting. He sums up the principal points again as follows: Illumination should be the criterion where it is not lower than 0.01 ft.-candle, while where it is lower the candle-power basis should be adopted. The illumination method will cover only about 20 per cent of the street lighting of England, and the balance of 80 per cent should be measured by candle-power.—London *Electrician*, May 16, 1913.

Train Lighting.—G. MATTAUSCH.—An illustrated description of a new system of electric train lighting. It is a combined dynamo and battery system, but the dynamo is not driven by an axle of the train but by a special wind turbine. There are, in fact, two generators, both coupled to the same turbine. The first generator provides current to the lamps while the train is running above a certain speed, while the other generator, which is in series with the first, charges during the same time the electric batteries which are discharged and supply current to the lamps when the train stops.—*Zeit. f. Beleucht.*, May 10, 1913.

Quartz Lamp.—An illustrated description of a new lamp which is a combination of the sun quartz lamp and the Cromeyer medical lamp. The former is used for sun baths in larger rooms, the latter for treating restricted portions of the body. The new quartz lamp is from 700 cp to 800 cp and is inclosed in a box. In one of its sides a smaller or larger slit may be produced so as to permit more or fewer rays to get out of the box.—*Elek. Zeit.*, May 8, 1913.

Generation, Transmission and Distribution

Starting and Speed Control of Induction Motors.—F. C. ALDOUS.—An abstract of a paper read at Manchester. Two types of motor are concerned—(1) the squirrel-cage induction motor with permanently short-circuited rotor; (2) the slip-ring induction motor with phase-wound rotor and external resistors. For constant-speed work the squirrel-cage motor is generally to be preferred to the slip-ring motor and can be used where its starting current is not objectionable. For motors of very large size the slip-ring type is generally preferred. For variable speed work the slip-ring motor is generally used. The squirrel-cage motor can be used for intermittent service, but only in small sizes or when the use of slip-rings is not desirable. When the speed is reduced continuously on heavy torque, the slip-ring motor is not suitable, owing to the constant rheostatic losses, and a multi-speed motor giving several efficient speeds is preferred. The multi-speed motor is also used where good speed regulation is required at several speeds. Where the torque at reduced speeds is diminished the slip-ring motor with rheostatic control is often the best system. For fan-driving, where the speed is occasionally reduced, the average power consumption with the slip-ring motor may be as low as or even lower than with other systems, as well as the first cost being lower. When starting a motor with an auto-starter, if the maximum current and the maximum torque at starting are measured at different voltages, the current drawn from the line is directly proportional to the torque developed. If the motor starts against a load consisting entirely of inertia, the total energy absorbed and the heating of the motor are independent of the starting voltage. If the load consists partly of a friction load, the energy absorbed and the heating are reduced if the voltage be increased. From this it is seen that a high starting voltage is generally advantageous. When the starting conditions are fixed and the friction of the load is fixed but the inertia is varied, then the time of starting, the total energy absorbed and the heating of the motor are proportional to the inertia of the load. The determination of the short-circuit current and the correct proportioning of the "slip" are of very great importance in the design of a squirrel-cage motor. The starting torque is dependent on the short-circuit current and upon the slip at normal load. The slip at normal load is not, therefore, a definite percentage, but depends on the required starting conditions. In the same way a motor with an inherently large short-circuit current can be built with a small slip. An account of the extended discussion which followed is also given—London *Electrician*, May 16, 1913.

Reserve of Water-Power Plant.—F. DREXLER.—In order to provide a reserve for the 1450-hp water-power plant at Amstetten at times of low water or high water, a Diesel engine of 400 hp has been installed and another one of 600 hp is to be erected later. The Diesel engine was chosen as it can be put into operation quickly.—*Elek. und Masch.* (Vienna), May 11, 1913.

Small Water-Power Stations.—C. REINDL.—A long illustrated paper on small hydroelectric stations with special reference to automatic regulation systems. Automatic regulation is absolutely necessary with small stations to keep the cost of attendance down.—*Zeitschr. f. d. ges. Turbinenwesen*, Vol. 8, 1912, page 145; briefly abstracted in *Elek. Zeit.*, May 15, 1913.

Electric Cranes.—R. LODER.—A profusely illustrated article on the different controller arrangements for direct-current and alternating-current cranes of the Siemens-Schuckert company.—*Elek. Zeit.*, May 15, 1913.

Traction

Electrification of Paris Suburban Railways.—J. REYVAL. —A review of the recent long paper by N. Mazen on the electrification of the suburban lines west of Paris operated by the French state railways. The author discusses, especially, the reasons why direct current at 650 volts has been adopted. There will be 400 to 500 motor cars fed with 650-volt direct-current energy from a third-rail. This energy is delivered from substations which are fed with three-phase energy at 15,000 volts and 25 cycles.—*La Lumière Elec.*, May 3, 1913.

Installations, Systems and Appliances

Voltage Regulator.—ROBERT EDLER.—The author gives an illustrated description of a new voltage regulator for generators. When the load changes an auxiliary hydraulic motor starts quickly the regulation by short-circuiting the regulating resistor. But simultaneously the lever of the regulating resistor is placed on the contact point corresponding exactly to the new load so that when the correct voltage has been obtained and the auxiliary motor is thereby brought back to its normal position the correct regulating resistance is available. This means that the whole regulating operation is completed.—*Elek. Zeit.*, May 8, 1913.

Electric Installations in China.—A note stating that in the district of the German Consulate of Charbin there are the following plants: The Eastern Chinese Railway has a steam-driven three-phase plant for supplying energy to 100 arc lamps and 5000 incandescent lamps and motors having

a total of 1200 hp. A gas-driven 200-volt direct-current plant at Kulajef supplies energy to 2000 incandescent lamps and motors of 20 hp. The three-wire, 2×220-volt direct-current plant at Mitschlof supplies energy to fifty arc lamps, 8000 incandescent lamps and motors of 60 hp. The 220-volt direct-current plant of Tschurin & Company supplies energy to 3000 incandescent lamps and motors of 25 hp. A 650-hp, 5000-volt, three-phase plant in Tsinanfu started operation in 1912. In the same city there are two more generating stations and two substations.—*Elek. Zeit.*, May 15, 1913.

Electric Installation of Aluminum Plant.—A description of the electric generating plant of the Vigeland aluminum works, which contains four direct-current generators, each of 250 volts, 8000 amp, running at 220 r.p.m. Three of these generators produce 2000 tons of aluminum per year.—*Schweiz. Bauz.*, No. 4, 1913; briefly abstracted in *Elek. und Masch.* (Vienna), May 18, 1913.

Safety of Electric Installations.—G. Dettmar.—A continuation of his long article giving in tables and diagrams a great many statistical data on electrical accidents, fires, etc., in German practice during the last twelve years.—*Elek. Zeit.*, May 15, 1913.

Fires in Central Stations.—André Gérard.—An article on the causes of fires in electric central stations, with some recommendations concerning means of preventing them in the erection of a new station.—*La Lumière Elec.*, May 3, 1913.

Wires, Wiring and Conduits

Determination of Voltage Drop.—Karl Meller.—With large transmission systems the voltage of the generating plant is usually kept constant so that the voltage at the consumers' terminals will vary according to the load. The author describes a simple graphical method for determining the voltage drop in overhead lines with high voltages due to load fluctuations so that it is possible to find quickly whether the voltage variations at the consumers' ends will remain within the permissible limits.—*Elek. und Masch.* (Vienna), May 11, 1913.

Crossings.—Paul Kvetensky.—An illustrated article on methods by which a high-tension wire may be carried safely over a telephone or telegraph wire without danger of breaking the wire.—*Elek. und Masch.* (Vienna), May 11, 1913.

Duralumin.—L. M. Cohn.—A review of the change of physical conditions of aluminum and its alloys by heat treatment or mechanical treatment, with special reference to duralumin.—*Elek. und Masch.* (Vienna), May 18, 1913.

Electrophysics and Magnetism

Traveling of Electric Waves.—R. Ruedenberg.—A mathematical article on the traveling of electric waves over lines with variable characteristic, the characteristic being defined as the square root of the ratio of inductance to capacity. Whenever there is a sudden change in the characteristic, the energy of the traveling wave is diminished since part of it is reflected. If the loss by reflection is to be made as small as possible the two lines with different characteristics are not put together directly, but a piece of medium characteristic is coupled between them. In this way the loss by reflection is reduced. In lines in which the characteristic varies continuously (not suddenly) the waves travel without great losses if the change is gradual compared with the length of the waves. The author develops the differential equation for lines which will be wholly devoid of reflection and makes an application to Pupin lines.—*Elek. und Masch.* (Vienna), May 18, 1913.

Spectroscopic Resolution of an Arbitrary Function.—C. V. Burton.—An abstract of a (British) Physical Society paper. An ordinary grating has periodic rulings, and a spectrum obtained by means of it is characteristic of the radiation entering the spectroscope slit. But if the radiation is homogeneous while the distribution of the rulings is arbitrary, we obtain a spectrum characteristic of the grating. It is thus found to be theoretically possible to resolve spectroscopically a given arbitrary function $f(x)$ into its harmonic constituents. The "permeability" of a photographic negative at any point being defined as the square root of the reciprocal of the "density," the first step is to make an "equivalent grating." This is a plate whose permeability (variable in one dimension only) has at any point x the value $A+B\ f(x)$, where A and B are constants. When this (transmission) grating takes its place in a spectroscope whose slit is fed with homogeneous light, the spectrum of the function $f(x)$ can be seen or photographed. Suitably interpreted, it gives the periodogram of $f(x)$. A description is given of a device which it is hoped may prove useful for determining the phases of the various harmonic constituents. The theory of the proposed method of resolving functions is discussed and is as complete as that of ordinary spectroscopy, while in one respect it is more simple; for, since the light entering the spectroscope slit is entirely of one wave-length, the comparison of intensities of spectral lines (whether visually or photographically) is facilitated. Some preliminary practical tests are now being made.—London *Electrician*, May 16, 1913.

Hysteresis Loop and Index.—W. M. Thornton.—An illustrated article giving a brief analysis of the forms of electric and magnetic hysteresis loops. It is found that a magnetic loop formed of curves, taken to be the same on both the rising and falling sides, agrees as closely with experimental results in alternating fields as the loops obtained by the point-to-point method, and that the means of the indices corresponding to these agrees with the Steinmetz coefficient 1.6, defined by $W=\eta B^{1.6}$ very closely, W being the energy dissipated per cycle and B the maximum flux density. The physical meaning of an index 1.5 is that the residual flux is proportional to the maximum number of molecular magnets per centimeter length ranged in line with the field per cycle, and the slightly higher index observed is explained by a linear polarization in weak fields, giving rise to a coercive force proportional to the maximum flux-density—that is, to the closeness of the packing of molecules which are ranged into line with the field in a plane at right angles to it.—London *Electrician*, May 16, 1913.

Units, Measurements and Instruments

Electromagnetic Instruments.—A. Schortau.—An illustrated article giving an outline of the principles of design of electromagnetic instruments. The author deplores the fact that there are too many types and sizes on the market in Germany, greatly increasing the cost of manufacture. With respect to size he recommends the practice of the Weston company, which has put on the market only two sizes, 242 mm and 170 mm in diameter. All the other manufacturers have built instruments varying between 90 mm and 300 mm in diameter, in about five different sizes. This is economically disadvantageous. The author outlines concisely the fundamental technical requirements which electromagnetic instruments must fulfil in order to be considered as "good" and which at the same time permit manufacture on a large scale and in an economical way.—*Elec. Zeit.*, April 24, 1913.

Insulating Batteries.—A. Wertheimer.—In measurements of the insulation resistances of cables it is very important that the high-voltage battery which serves as the source of current be very carefully insulated from earth. The author gives tables of the insulation of a battery consisting of twelve groups each of 40 volts in which special arrangements were made to improve the insulation. The different connections of the battery during charging, discharging and while making insulation measurements are explained and illustrated in diagrams.—*Elek. Zeit.*, May 15, 1913.

Testing.—In a continuation of the long serial on shop-testing of electrical apparatus the description of tests of direct-current machines, shunt and compound generators, is continued. The present instalment deals with the determination of resistance and copper loss, core loss and saturation tests, the retardation method of determining core losses, voltage regulation and efficiency.—*Elec. Journal,* May, 1913.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—An illustrated description of the Goldschmidt high-power wireless station at Hanover, Germany. The generating plant consists of a 500-hp locomobile which drives two 150-kw generators by belt, the armatures of these machines being directly connected with the motor of the high-frequency alternator. The latter machine consists of a stator and rotor, each of which carries a winding forming 384 poles. If, for instance, the machine runs at a speed of 3130 r.p.m., and the stator winding is excited by continuous current, alternating current will be produced in the rotor with a frequency of 10,000 cycles per second. The stator is excited from the continuous-current generator *A* or a battery (Fig. 3). This battery is protected by a block choking coil *B* from the effects of the alternating voltage produced in the stator of the Goldschmidt machine, the choking coil at the same time preventing the alternating energy in the antenna from passing to earth through the exciter. The alternating current of 10,000 cycles produced in the rotor by mechanical rotation in the constant magnetic field of the stator passes, as shown, through a circuit consisting of an inductance coil and a condenser *C,* which is connected across the slip-rings *SS* of the rotor winding. This inductance and condenser are tuned so that the whole rotor circuit is in resonance for 10,000 cycles, thereby minimizing the continuous exciting current in the stator necessary for producing a certain current in the rotor. Owing to the reaction of the rotor winding carrying 10,000 cycles on the stator a frequency of 20,000 cycles is produced in the stator. The stator winding is tuned for this frequency of 20,000 cycles by the combination of an inductance coil and condenser *D,* so that the 20,000 cycles have a well-tuned path to flow in. These 20,000 cycles in the stator react again on the rotor and produce here a frequency of 30,000 cycles, the rotor winding being tuned to this frequency by the condenser *E.* Naturally, in selecting the combination of the inductance coil and condensers *C* for the tuning to 10,000 cycles, as well as for the selection of the condenser *E,* account must be taken of the two tuning circuits in parallel affecting one another, but by careful correction the tuning of the rotor circuit for both 10,000 and 30,000 cycles can be carried out very exactly.

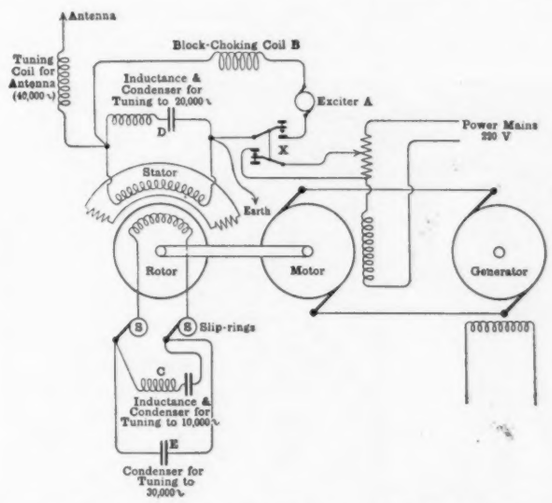


FIG. 3—CIRCUIT DIAGRAM OF HIGH-POWER WIRELESS STATION

Through the reaction of the current (at 30,000 cycles) in the rotor, 40,000 cycles are produced on the stator terminals, which are connected to earth and to the antenna as shown in the diagram. The machine is operated by the key *F* in the exciting circuit, which, besides exciting the alternator and thus supplying energy to the antenna circuit, controls the speed of the machine through a relaying device as follows: The field of the generator is separately excited and runs at a constant predetermined speed. Energy for the field circuit of the driving motor is also supplied from the mains. This circuit contains a resistor which can be cut in or out as the switch *X* is opened or closed; that is, when energy is being supplied to the antenna. As a result the motor tends to speed up a sufficient amount to counteract the tendency of the generator speed to drop owing to the increased output. The result is that the speed of the Goldschmidt generator remains constant at 3100 r.p.m.—London *Electrician,* May 16, 1913.

Loaded Telephone Cables.—A note on a recent British patent (No. 9309, 1912) of the Western Electric Company. Pupin coils for loaded submarine telephone cables are made up in long moisture-proof cases. These are joined into the cable during laying, and the end plugs which close the casing are welded to it after the coils and connections are in place. To this end the plugs are provided with recessed faces for the application of water jackets during welding.—London *Elec. Eng'ing,* May 15, 1913.

Miscellaneous

Exposition in Belgium.—J. B. PICOT.—A brief account of the official opening of the Gand exposition in the presence of the King and Queen of Belgium. The French, English and German sections cover 45,000, 17,000 and 15,000 sq. m respectively. The author mentions some exhibits in the French electrical and metallurgical sections and in the Belgian sections.—*La Lumière Elec.,* May 3, 1913.

Book Reviews

LA THÉORIE DU RAYONNEMENT ET LES QUANTA. Rapports et Discussions de la Réunion tenue à Bruxelles du 30 Octobre au 3 Novembre, 1911. Sous les auspices de M. E. Solvay. Paper; 461 pages. Price, 15 francs.

A valuable compendium of the papers and discussions offered at a "physical conference" held at Brussels, Belgium, in November, 1911. This conference was international in a broad sense, being attended by delegates from Belgium, Germany, England, France, Austria, Holland and Denmark, but America does not seem to have been represented. The papers presented were mainly directed to the mathematical laws of radiation. All of them are important papers, although most of them relate to recondite mathematical and physical topics. The volume will be valued as a reference book by advanced students of physics, chemistry and molecular physics.

ELECTRICAL DIAGRAMS. By Charles F. Bouder and Ralph P. Earle. Philadelphia. Copyright by authors. Printed on blueprint paper. 54 diagrams.

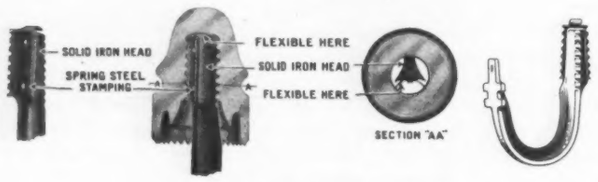
This book contains a collection of wiring diagrams of call systems, simple lighting circuits and connections for various types of motors. There are in all fifty-four diagrams with short explanatory text to each one. The text as well as the diagrams is purely elementary, the diagrams being well selected in order to give a clear conception of the fundamental principles in electric wiring. Each diagram brings out clearly the connections of the system it represents. The book was originally prepared as a text for trade-school courses, but it will also be found useful by wiring men of limited experience.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Flexible Clip for Insulator Brackets

The Line Material Company, South Milwaukee, Wis., has brought out an insulator bracket with a flexible clip which provides protection against expansion, contraction and irregularities in the insulator grooves. A full section



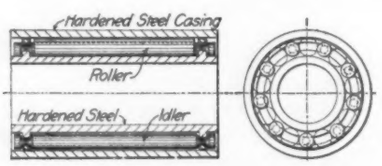
DETAILS OF FLEXIBLE CLIP

of the malleable-iron bracket enters the insulator and a part section of this is used as a thread for the insulator. The clip adjusts itself both as to diameter and length. The high-grade malleable iron used in making these brackets, it is claimed, will outlast steel, and this, together with the ability to absorb sudden strains or jerks, tends to insure long service. The illustrations show the construction of the clip and a new type of malleable-iron one-piece bracket fitted with the clip.

Non-Lubricant Roller Bearing

A new type of bearing called the "California" roller bearing has recently been placed on the market by the American Roller Bearing Company, Pittsburgh, Pa. It is of the non-lubricant anti-friction type and consists of four parts: sleeve, rollers, spacers and outer casing. The sleeve fits on the shaft and is made of hardened steel and the outer casing fits inside of the hub of the wheel, pulley or bearing. Cylindrical rollers are circumferentially spaced by means of idlers between these sleeves. These idlers are smaller in diameter than the rollers and run on a separate track. They are held in place by two retaining rings. When end thrust has to be taken care of in a bearing it is provided for by a ball race or a nest of cylindrical rollers of the non-lubricant type.

It is stated that the Pennsylvania Railroad Company, in its Olean (N. Y.) shops, has used these bearings in a large Sturtevant blast fan which has made 2400 r.p.m. twenty-



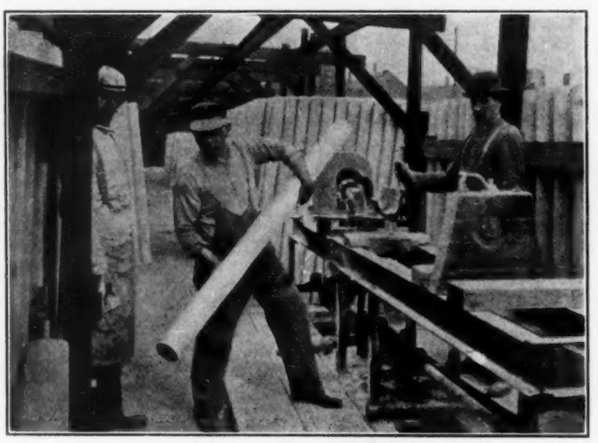
SECTIONS OF ROLLER BEARING

two hours a day for three years without lubrication, the bearing still being in first-class condition. It is also stated that in tests made on the Pennsylvania Railroad a locomotive bearing was in service more than 20,000 miles, sometimes with a train speed of seventy miles an hour, with the California bearings constantly cool while the ordinary bearings were considerably overheated.

Molded-Concrete Conduit

A type of conduit called "stone-duct," made by the Chicago Stone Conduit Company, 137 South La Salle Street, Chicago, is of considerable interest. It is a pipe conduit made of concrete molded by the Graham process. Both the inside and the outside of the pipes are machine-finished so as to give perfectly smooth surface. This is of importance particularly in regard to the inside as it minimizes the labor of rodding and cable drawing. The pipes are made in 6-ft. lengths and the ends are provided with metal rings. These rings, which are used for connecting two sections of duct, form a tight joint, making it impossible for any foreign articles to get into the duct. This is a particularly desirable feature in connection with installations in wet sand or mud.

It is claimed that this type of conduit is not injured by arcs occurring within the conduit. Consequently, trouble on



REAMING CONCRETE CONDUIT

account of arcs in one conduit is not communicated to the cables in adjacent ducts.

When this conduit is laid with an envelope of courser concrete, it forms a monolithic mass, as the concrete envelope makes an excellent bond with the concrete duct. The ducts can be readily cut with an ordinary cross-cut saw. It is stated that the weight per linear foot is less than that of tile, with a consequent advantage in transportation. No skilled labor is required for its installation.

Oil-Pressure Thrust Bearing

A new type of oil bearing was recently invented by Mr. Albert Kingsbury, consulting engineer, Pittsburgh, Pa. Of particular interest in this bearing is that oil pumps are entirely omitted and that, instead of pumps, the viscosity of the oil is depended upon to maintain the film. Bearings of this type have been installed at several of the hydroelectric plants, and three bearings are being installed at the new Keokuk station.

In general the design consists of a collar rotating with the shaft and sliding on stationary parts arranged to receive the thrust, the whole being submerged in a bath of oil. It resembles to some extent the ordinary collar thrust bearing

such as is used on line shafting, etc., but it differs from the common type in one essential feature. In the ordinary collar bearing the stationary bearing surface is provided by a continuous ring, while in the new bearing this ring is divided into several independent sectors or shoes, generally six in number. Each of these shoes is so supported against the thrust that it may independently align itself to the best bearing conditions at the sliding surface, thereby enabling the lubrication to be effective in the highest degree.

The self-adjusting feature of the shoes is generally provided by rounding one of the supporting surfaces at the back of the shoe so that the shoe may rock or pivot over a point near its center of area. These shoes are loosely held in a supporting ring, which is generally provided with a spherical seat permitting alignment of the group of shoes as a whole to the rotating collar. In some cases, as in very large bearings, each shoe has an adjusting wedge for equalizing the load on the shoes.

Generally the collar is made of cast iron or mild steel and the shoes of cast iron or cast steel faced with babbitt metal. For very heavy loads at slow speeds harder materials are used, such as chilled cast iron or bronze shoes. The bearing is made in halves when required for assembling without removing the shaft collar.

The explanation of the effect of the rocking support for the shoes is that this feature insures conditions of lubrication similar to those in cylindrical bearings, such as railway axle bearings, which are capable of sustaining relatively high unit pressures at high speeds, while flat surfaces, such as ordinary plain collar or footstep bearings, are in general suitable only for moderate pressures and speeds. Careful experimental and theoretical investigations have shown that in well-fitted cylindrical bearings the sliding curves are separated by a very thin film of oil which is under a static pressure equivalent to the load on the bearing. All the friction in this case occurs in the oil, not between the metals, and the coefficient of friction is relatively low. The film invariably has a wedge form, being thicker at the edge where the oil enters with the rotation of the shaft and thinner toward the leaving edge, the difference in many cases being only a fraction of a thousandth of an inch. The film is maintained by reason of the adhesion of the oil to the shaft in its rotation and by the viscosity of the oil. It has also been proved that the wedge form of the film, although the degree of taper is extremely small, is absolutely essential for low friction and high load-carrying capacity. In cylindrical bearings the wedge-shaped space for the film is provided by a slight difference in the radii of the surfaces, or by a slight eccentricity, or both. In ordinary collar and foot-step bearings it is evident that the conditions do not permit the formation of the oil wedge, and consequently the lubrication is imperfect; there is relatively little oil between the surfaces and there is more or less metallic friction, with a correspondingly high coefficient of friction and often troublesome heating and wear. In the bearing here described each shoe is free to adjust itself to the collar; hence the desired wedge-shaped film is formed between the shoe and the collar.

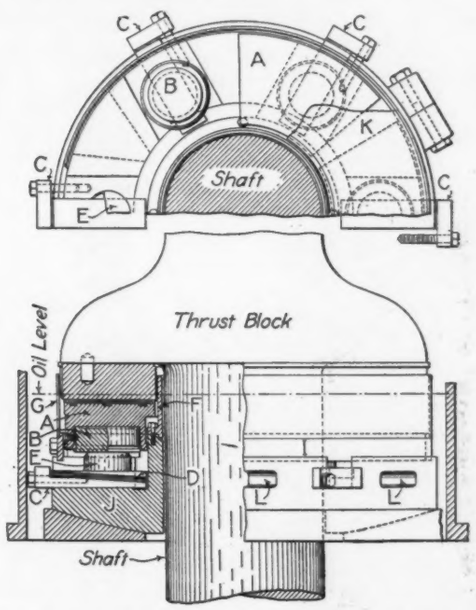


FIG. 1—DETAILS AND PARTIAL SECTION OF BEARING

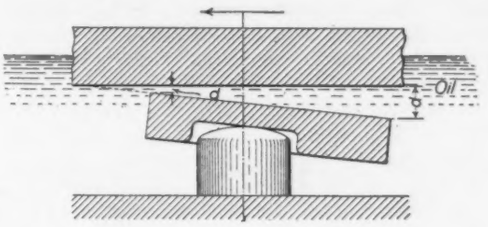


FIG. 2—FILM OF OIL IN BEARING

This bearing is being built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Direct-Current 2400-Volt Locomotives

The electrification of the Butte, Anaconda & Pacific Railway is of exceptional interest, this being the first installation in this country utilizing the 2400-volt direct-current system. The construction work necessary to effect the change from steam to electric equipment is now practically completed.

The adoption of the 2400-volt direct-current system for this railway was determined after a comprehensive study of local conditions and requirements. The traffic demands are unusually severe and consist principally of hauling long trains conveying copper ore over heavy mountain grades. In comparison with other existing systems, the 2400-volt direct-current system was considered best suited for service of this character.

The Butte-Anaconda section, which has now been equipped, comprises 30 miles of main-line single track and numerous sidings, yards and smelter tracks, aggregating a total of about 90 miles on a single-track basis. The haulage of copper ore from the Butte mines to the smelters at Anaconda, together with all mine supplies, lumber, etc., moving in both directions, amounts to practically 5,000,000 tons of freight per year. Complete freight trains weighing 3400 tons are made up of fifty loaded steel ore cars and will be handled against a ruling grade of 0.3 per cent by a locomotive consisting of two of the units illustrated. Single units will be used for making up trains in the yards and for "spotting" cars.

The initial equipment consists of seventeen locomotive units, fifteen for freight and two for passenger service. Each unit weighs approximately 80 tons. The two units for forming the freight locomotives in each case will be coupled together and operated in multiple unit. The combination freight locomotives will haul the usual trains of 3400 tons at a maximum speed of 15 miles per hour against the ruling grade and at 21 miles per hour on level tangent track.

The passenger locomotives are of the same design as the freight locomotives, but they are geared for a maximum speed of 45 miles per hour on level tangent track. A schedule of eight passenger trains per day, four each way, is maintained, the average train being composed of a locomotive and three standard steam-road passenger coaches.

All the locomotive equipment, as well as the substation apparatus and overhead line material, was designed and built by the General Electric Company.

The locomotives are of the articulated double-truck type with all weight on the drivers. On each axle is mounted a motor of the twin-geared type.

The engineer's compartment, at each end of the cab, contains controller, air-brake valves, bell and whistle ropes, ammeter, air gages, sanders and other control apparatus that should be within immediate reach of the engineer. These compartments are heated electrically.

In the central section of the cab is grouped the control apparatus. The contactors, reverser and rheostats are mounted in two banks running lengthwise of the compartment and are arranged with ample space between them to afford convenient access for cleaning, inspection and repair. All parts and circuits carrying 2400 volts are thoroughly protected from accidental contact. A dynamotor is employed to furnish 600 volts for the operation of the contactors, lamps and air compressor. The motors are of the commutating-pole type, wound for 1200 volts and insulated for 2400 volts. A forged pinion is mounted on each end of the armature shaft and meshes into a corresponding gear mounted on the wheel hub. The gear reduction is 4.84 on the freight locomotives and 3.2 on the passenger locomotives.

The continuous rating of each motor is 190 amp at 1200 volts under forced ventilation and 225 amp at 1200 volts for one-hour rating. For the double-unit 160-ton locomotive this is equivalent to a continuously sustained output of 2100 hp.

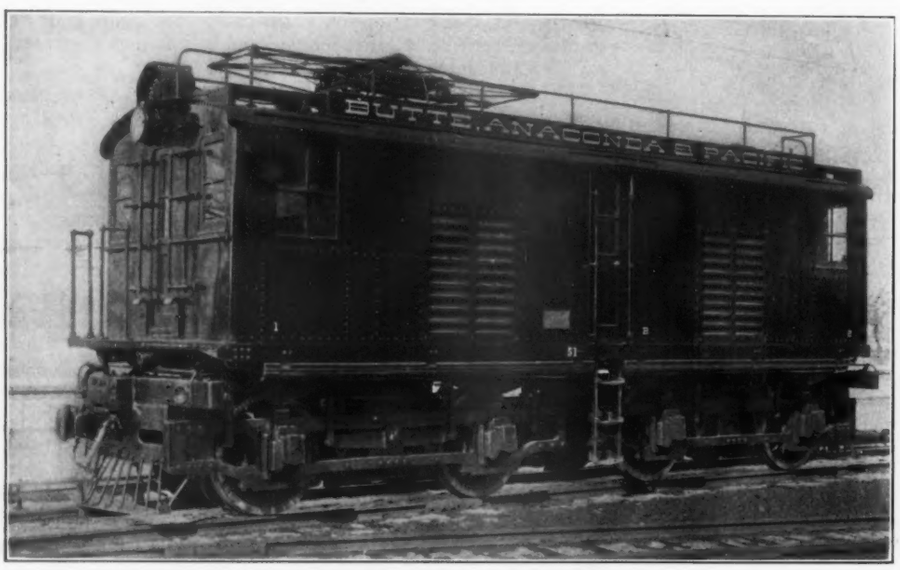
The control equipment on the locomotives is the Sprague-General Electric multiple-unit control and is designed to operate the four motors in series and series-parallel. The pairs of motors with their respective resistors are connected in series on the first point of the controller. The resistance is varied through nine points on the controller and finally short-circuited on the tenth or running point. The pairs of motors are then operated similarly in series-parallel and all resistance is cut out on the nineteenth point, which is the full-speed running point. This plan provides a control with ten steps in series and nine steps in series-parallel.

The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The smooth transition between control points permits acceleration close to the slipping point of the wheels. A switch is provided having manually operated handles for cutting out either pair of motors, so that the locomotive can then be operated with one pair of motors in the usual way.

The main switch is provided with a powerful blow-out so that heavy currents can be opened. The three smaller switches, one for each of the two heaters and one for the dynamotor circuits, are designed specially for 2400 volts. The blade is controlled by a lever attached to the grounded part of the locomotive frame and insulated from the live parts of the switch by a rod of treated wood.

There is one main fuse for the trolley circuit and two fuses for the motor circuits. They are all of the copper-ribbon type and are fitted with hinged covers to facilitate fuse renewals. The boxes are placed as near as possible to the overhead trolley in order to protect the wiring circuits near the source of supply. There is also an auxiliary circuit fuse for protecting locally the dynamotor and heater circuits. The main, motor and auxiliary fuse boxes are provided with powerful magnetic blow-outs, energized by current passing through the fuse, to insure proper rupture of the arc.

The overhead trolleys are pneumatically operated from the engineer's compartments by a hand-operated valve. The passenger locomotives are equipped with two collectors and the freight unit with one collector. A 2400-volt insulated bus line connected direct to the pantograph is run along the center on the roof of the cab. The bus lines are connected by couplers between the two units of the freight locomotive, so that current is obtained from both collectors or from a single collector. The collectors and bus lines are adequately guarded by railings.



80-TON DIRECT-CURRENT LOCOMOTIVE FOR 2400-VOLT OPERATION

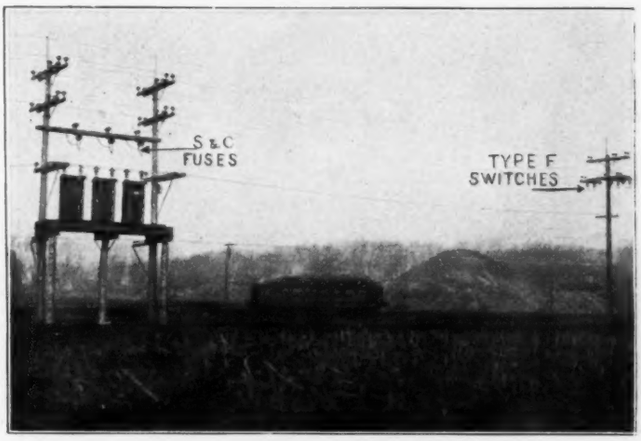
Water Sterilizer and Receptacle

The Forbes Company, 1208 Callowhill Street, Philadelphia, Pa., has added to its sterilizing apparatus a receptacle for pure water to prevent any possibility of contamination. The raw water supplied from the upper bottle is sterilized on the heat-treatment principle by passing it over electric heating units, is again cooled and delivered to the receptacle or lower bottle. A part of this receptacle extends down onto the ice cooler, from which it can be drawn through an ordinary faucet. By this method there is no possibility of contamination from ice or handling. The complete outfit of sterilizer and receptacle is shown in the accompanying illustration.

WATER STERILIZER

High-Tension Weatherproof Transformers

A simple inexpensive installation of outdoor high-tension transformers used for supplying energy to pumps is shown in the accompanying illustration. The transformers are rated at 25 kva and are mounted on a platform large enough to accommodate 50-kva units in case the load should increase. Carbon-tetrachloride fuses mounted above

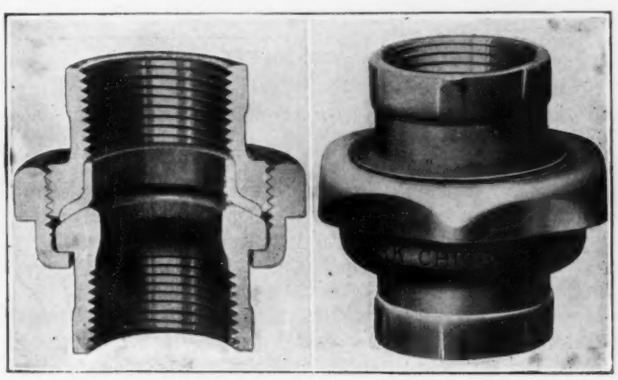


OUTDOOR TRANSFORMER STATION

the transformers can safely be replaced by opening the disconnecting switches mounted on the next pole. This particular type of installation is especially suited for supplying energy for small motors where the cost per kilowatt for equipment and installation must be kept at a low figure. Opportunities for this class of service occur along practically every high-tension line. The installation shown in the illustration was made by the Delta-Star Electric Company, Chicago.

Cold-Drawn-Steel Union

A pipe-union made of cold-drawn steel has recently been placed on the market by the Mark Manufacturing Company, Chicago, Ill. It consists of the usual three main parts, namely, male and female ends joined by a coupling nut. These parts, as well as the brass seat ring, are drawn cold from flat stock, thereby obtaining a fitting that is said to be seamless and free from sand holes, pin holes or similar



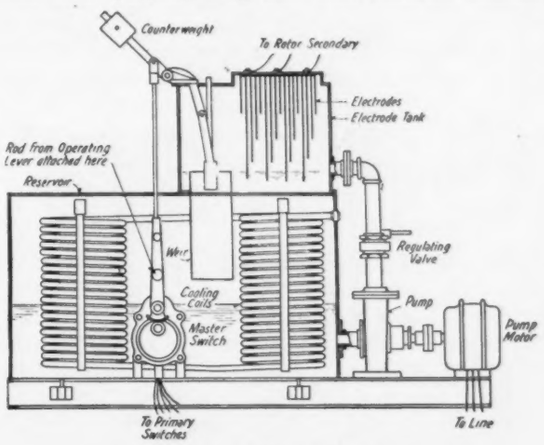
PIPE UNION OF COLD-DRAWN STEEL

structural defects. As the union is threaded to the Briggs standard for pipe threads, it carries the same taper as the pipe instead of being tapped straight through as most unions are. The union is made of the same material as wrought-steel pipe, and therefore leaks are eliminated because of the equal expansion and contraction of the union and pipe. Another novelty is the densified hardened steel seat which is formed by applying the die with such great pressure that the metal is hardened and a smooth, accurately shaped surface is given to the seat. When the coupling nut is screwed into place the densified seat and the opposing soft brass ring in the female end make a joint which is leak-proof even under extreme pressures. Both seat and ring are formed in dies without machining or grinding so that the fit of one face against the other is exact. After the threads are cut, the union is also sherardized to provide against corrosion, but this protection does not alter the sharpness and fit of the threads.

Liquid Rheostats for Large Alternating-Current Motors

For use with large alternating-current slip-ring motors driving mine hoists, winding gears, rolling mills, etc., the Westinghouse Electric & Manufacturing Company has developed a new type of liquid rheostat provided with a large number of steps between the minimum and maximum limits, thus permitting fine speed adjustments and smooth acceleration. The rate of acceleration can be definitely fixed and is independent of the rate at which the operator manipulates the starting lever.

The principle of operation of these rheostats is shown by the accompanying diagram. The rheostat consists of



SECTION THROUGH RHEOSTAT

two compartments, an upper tank for the electrodes and a lower reservoir. The three phases of the rotor are connected to electrodes suspended in the upper tank. A small motor-driven pump sends a steady stream of liquid, usually a solution of soda, from the reservoir into the electrode tank and back into the reservoir over the weir. By raising or lowering the weir, the height of the liquid in the electrode tank is correspondingly varied. The resistance in the rotor circuit decreases as the liquid level rises, and vice versa, and the motor speed, of course, changes with the rotor resistance.

The primary circuit of the motor is closed and opened by means of electrically operated switches, which are controlled by a master switch mounted on the rheostat. The operating lever of the rheostat controls both the master switch and the weir. When the lever is in its central or "off" position the primary switches are opened and the weir at its lowest level, so that the secondary resistance is a maximum. Moving the lever in one direction closes the proper primary switches for starting the motor forward and raises the weir. Moving the lever in the opposite direction reverses the motor and again raises the weir. Speed control is secured by varying the position of the weir by moving the lever; the primary switches do not open until the lever is placed in the off position.

A valve in the intake pipe of the electrode tank regu-

lates the rate at which the liquid is pumped in, so that no matter how quickly the operating lever is moved the liquid can only rise at the rate for which the valve is adjusted, thus fixing the rate of acceleration. When the lever is returned to the "off" position the weir drops and the liquid level promptly falls.

Cooling coils in the reservoir prevent rapid evaporation of the liquid. These rheostats are made in ratings from 400 hp to 1500 hp.

Splicing Sleeve

In the past considerable trouble has been experienced with transmission-line splicing sleeves owing to the fact that after they had been twisted over the wire they did not

FIGS. 1 AND 2—DOUBLE-TUBE SLEEVE BEFORE AND AFTER TWISTING

fit snugly to the conductor at all points. This led to difficulty as it allowed a vacant space in which moisture collected and caused corrosion of the sleeve and the conductor. It is claimed by the manufacturers of the sleeve here shown that when properly installed on a splice it will not allow moisture to creep into the joint, all clearance spaces having

FIG. 3 AND 4—OVAL-TUBE SLEEVE BEFORE AND AFTER TWISTING

been reduced to a minimum and the twisting of the sleeve taking out all of the slack in the splice. As will be noted, the splice does not have a separate compartment for each wire, as did the older designs, but consists of a seamless oval tube. It has been placed on the market by Hickey & Schneider, 227 Fulton Street, New York.

The Motograph Sign

One of the novel outside electrical features which aroused widespread interest among hundreds of N. E. L. A. convention delegates at Chicago was the "motograph." This is a panoramic "talking sign" operated by perforated paper rolls. It is located on the roof of the Commonwealth Edison Company's North Market Street building and is seen most prominently from the Chicago & Northwestern station. It is the first installation of this device in Chicago.

The peculiar and rather mystifying effect of the motograph on the spectators is due to the rapid-fire manner in which the reading matter is introduced onto the bulletin panel. Each letter appears at the extreme right, travels the entire length of the sign and disappears at the extreme left. There is a continuous flow of letters, three or four words being visible constantly.

The installation was made by the Motograph Company of America, Detroit, Mich. The work of construction was completed in eleven days, night shifts being employed to insure completion in time for the convention.

One of the many messages flashed on the bulletin panel was: "Welcome, N. E. L. A. convention delegates. We hope your visit to Chicago will prove enjoyable, profitable and memorable."

The motograph displays the advertising bulletins under a moving washing machine and figure of a woman operator. It is said to have attracted so much attention from the public that the traffic division of the Chicago Police Department requested the Commonwealth Edison Company to limit the perforated rolls to lengths of not longer than three minutes' duration.

The installation consists of a bulletin panel containing 1360

MOTOGRAPH SIGN IN CHICAGO

10-watt, 115-volt tungsten lamps arranged in ten horizontal rows of 136 lamps each. The lamps are 4.5 in. apart. The total length of the bulletin panel is 51 ft. The height of the letters produced is 4 ft. The entire electrical display is 65 ft. long and 70 ft. high.

The perforating machine will produce old English, script or block letters and even complicated characters such as Chinese symbols if desired.

The operating device is an automatic motor-driven controller of special design which operates the perforated tape and effects a quick succession of "makes" and "breaks." The paper tape is said to run through the controller at the rate of 33 ft. per minute. The roll used in this particular installation contains 100 words, operates continuously for three minutes and then repeats.

Fractional Horse-Power Motors

Small motors are finding a great many new applications and some of these are made in astonishingly large numbers. For example, 20,000 motors of this type have been put out in drink mixers alone by the Hamilton-Beach Manufacturing Company, Racine, Wis. Motors made by this company have also been applied to portable grinders for machine shops, hair and shoe driers and fans, and are built for almost any other purpose where the requirement is for fractional horse-power. In these motors use is made of double-silk-covered wire dipped and baked three times. The commutator is made practically a solid piece under 10 tons pressure. Nickel babbitt with a rifle-bore finish forms the bearings. Particular care has been taken to make the provision for lubrication as simple as it is effective in keeping oil distributed over the entire bearing surface. The diversified applications of fractional horse-power motors have produced a large number of entirely new electrical devices which create markets not heretofore open to energy-consuming devices of any kind. One example is a drier made especially for shoe-cleaning stands, which have not heretofore contributed to central-station revenues.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Demand for Dry Batteries Undiminished.—The Manhattan Electrical Supply Company, of 17 Park Place, New York, reports that the demand for its Red Seal batteries is undiminished and that, although the sales of this product last year were record-breaking, the indications are for an increase during the present year.

Annual Meetings of Two Large Corporations.—During the coming week there will be held the annual meetings of two companies prominent in the electrical field. On June 9 at 2 p. m. that of W. S. Barstow & Company will take place at 50 Pine Street, New York. The Westinghouse Electric & Manufacturing Company will hold its meeting at its main office in East Pittsburgh, Pa., on June 11 at 10 a. m.

Cold-Storage-Plant Installation.—The Alex. R. Benson Company, of Hudson, N. Y., manufacturer of Yager's soldering fluxes, has just completed the installation of a large cold-storage plant and additional machinery for the manufacture and preservation of its products. Difficulty is always experienced in hot weather in keeping soldering fluxes in proper form for immediate use, and the cold-storage system is designed to assist materially in preserving the fluxes until the moment of shipment.

Turbo-Generator Market.—An interesting chart has recently been compiled by Siemens & Halske A. G., of Berlin, Germany, showing a graphical summary of the comparative growth of the firm's generator business from 1904 to 1912 inclusive. During this period turbo-generator sets of the direct-current type totaling about 200,000 kw have been manufactured, while in the same length of time alternating-current-type turbo-generators totaling in the neighborhood of 1,500,000 kw have been turned out.

Stock of Baltimore Utility Offered in London.—The portion of the $3,500,000 issue of 5 per cent debenture stock of the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., not taken by stockholders has been offered to English investors by the London Joint Stock Exchange at 96. Shareholders of the company both here and abroad were allowed to subscribe to the new stock on the basis of one share of new stock for four shares of either common or preferred stock held, the price being the same as that above mentioned.

Automobile Electrical Accessories Standardized.—In order to secure to the buyer uniformity of quality and ease of replacement, the Adams-Bagnall Company, of Cleveland, Ohio, has developed a standard line of electrical apparatus for automobiles, which it claims is the most complete manufactured in this country. The line includes both single-unit and double-unit combined starting and lighting systems, lamps, trumpets and switches. The latter are arranged for the control of the starting and lighting systems and also for the regulation of the brilliancy of the lamps without the use of resistors.

Inclosed-Arc Lamps Replaced by Tungsten Lamps.—The Cambridge Electric Light Company, Cambridge, Mass., reports that a year ago it was supplying energy to 660 street lamps of the inclosed-arc type rated at 6.8 amp and that during the year all of these lamps have been replaced by 250-cp tungsten lamps installed in the same fixtures. The company has recently contracted with the city of Cambridge for the installation of fifty-two luminous magnetite lamps of the inverted type and more than 200 tungsten series lamps of 40-cp rating to replace the gasoline street lamps in use on the Cambridge Parkway.

More Sales of Electric Trucks.—In answer to an inquiry as to the present activity in trucks the General Motors Truck Company, of Pontiac, Mich., sends the following data on recent orders for electric trucks: Thirteen for the New York Edison Company, one for the Plattsburgh (N. Y.) Gas & Electric Company, five 3-ton trucks for the Carson-Pirie-Scott Company, of Chicago, Ill., and three 2-ton trucks for the Kansas City (Mo.) *Star*. The Cambridge Electric Light Company also reports that it has just received two 5-ton G. M. C. electric trucks, equipped with Edison storage batteries and Lally dump bodies, which will be used to carry coal from tidewater to its power plant, a distance of 2 miles.

Great Western Power Company Extensions.—Work is progressing on the installation of an additional 20,000 kw of generating equipment at Big Bend, Cal., and an impounding dam is projected at Big Meadows, Cal., to supply water for 600,000 kw future development. When the work now in progress is completed the Great Western Power Company will have available a large amount of electrical energy, and it is opening new markets for this. The company has at present a large contract for supplying energy to the Pacific Gas & Electric Company, and it is stated that when this expires, early in 1914, it will be replaced by new contracts calling for fully as large a delivery. The financial condition of the company seems excellent, earnings are increasing, and the annual report should prove very satisfactory to the stockholders.

Independence of the Crocker-Wheeler Company.—With reference to the statement appearing in the Underwood tariff bill report to the effect that the Crocker-Wheeler Company is a "trust," owning or controlling three plants, a letter was issued recently to a number of the New York papers by Dr. S. S. Wheeler, president of the company, containing the following statement of the facts of the case: "The Crocker-Wheeler Company does not now and never has owned or controlled more than one manufacturing plant. The company is not now and never has been a combination or trust in any sense of the word. It has never been 'financed' or merged with any other company or combination. It has preserved its absolute independence for nearly a quarter of a century, a period covering practically the entire industrial development of electricity."

Hydroelectric Developments in New England.—Two contracts for hydroelectric equipment have just been awarded to the S. Morgan Smith Company, of York, Pa. The first, by the Greenfield Electric Light & Power Company, of Greenfield, Mass., was for two 1450-hp waterwheels, directly connected to umbrella-type generators, also for a 135-hp exciter set. The two main units will operate under a 37-ft. head at a speed of 150 r.p.m and will be set in concrete scroll cases similar in design to those in use at the Keokuk development. The second contract referred to was awarded by B. W. Page, of Skowhegan, Maine, in connection with a plant to be built at Jackman, Maine, for general industrial and lighting purposes. At this location a wood-stave pipe 3700 ft. long is to be built, and the generating equipment to be installed will consist of a Francis turbine, developing 180 hp under a 210-ft. head at a speed of 900 r.p.m., directly connected to a General Electric generator and furnished with a Lombard governor.

Electrical Equipment for Industrial Companies.—Orders for the following pieces of electrical apparatus are among those recently placed with the General Electric Company: Two 500-kw Curtis turbo-generator units, one for the Hyatt Roller Bearing Company, Harrison, N. J., and the other for Albert Schwill & Company, Chicago, Ill.; one 10-kva and three 150-kva transformers, fourteen motors ranging from 5 hp to 100 hp, switchboard apparatus and accessories for the Empire Gypsum Company, Garbutt, N. Y.; three 300-kw transformers and thirty-one motors ranging from 5 hp to 100 hp for the Baltimore Pearl Hominy Company, Baltimore, Md.; transformers, oil switches

and controller panels and eighteen motors ranging from 15 hp to 400 hp for the Boston Woven Hose & Rubber Company, Cambridge, Mass.; one 75-kw alternator, one 3-kw exciter, six 25-hp motors and a switchboard for the Avery Company, Peoria, Ill.; switchboard apparatus and accessories and ten motors ranging from 10 hp to 100 hp for the Grantville Oil Mill, Grantville, Ga.

Increasing Demand for Brushes.—Mr. W. J. Jeandron, United States agent for the "Le Carbone" brushes, recently returned from a visit of six weeks in Europe, where he spent ten days in the factory of the Le Carbone Company arranging for a larger production to meet the increased demand for these brushes in the United States.

Large Power Contract Closed in Minneapolis.—The Minneapolis General Electric Company recently closed a contract with the Minneapolis Steel & Machinery Company, covering 1066 hp at present and ultimately 1500 hp, for a period of ten years. The machinery company makes, among other things, steam engines. It has been operating its own power plant for over twenty years and is the largest concern of its kind in the city.

Financial Statement of a Pittsburgh Utility Company.—The American Water Works & Guarantee Company, of Pittsburgh, Pa., reports net earnings for the fiscal year ended April 30 of $1,704,500, as compared to $1,090,061 in 1912 and $823,133 in 1911. The properties of the company are scattered through seventeen states, and there will be issued and mailed to its stockholders on June 11 a complete report of them, including a number of views.

Pumping Water for Irrigation in California.—At Stockton, Cal., the water level is so near the surface of the ground that it has been found very cheap to raise water for irrigation purposes by means of electrically operated pumps. More than 300 pumping plants have been equipped for this purpose with electric motors, and this business has been secured by the Western States Gas & Electric Company, which since the first of the year has gained 2249 hp of power business.

Planning a Copper Merger.—The Consolidated Copper Mines Company, recently incorporated in Delaware, is making an effort to form a combination with the Giroux Consolidated Copper Company, the Butte & Ely Copper Company, the Copper Mines Company and the Chainman Consolidated Copper Company. At the present time the Giroux and Copper Mines companies are the only producers, but it is believed that further development of the other properties under a single management will prove profitable.

Electric Power for Zinc Mining.—A contract has recently been closed between the Interstate Light & Power Company and the Mineral Point Zinc Company, both of Galena, Ill., for the delivery of energy to 310 hp of electric motors, to operate in the Black Jack Mine near Galena. The greater part of the energy used in the lead and zinc mines in this territory is supplied by the Interstate company. Mining activities, which were temporarily affected by the tariff measures, are resuming their normal condition and several new mines are being opened up.

New Power Plant to Start Up at Gadsden, Ala.—A new steam generating station will be put in operation at Gadsden, Ala., during the coming month by the Alabama Traction, Light & Power Company. Energy will be delivered from this station to Anniston, Sylacauga, Talladega, Alexander City, Pell City, Leeds, Birmingham and Gadsden. The equipment at the Gadsden station consists of two generating units, with six boilers, and mechanical fuel and ash handling apparatus. The generating voltage will be 2300 and this will be stepped up to 110,000 volts for transmission.

Automatic Stoker Installations.—Through Mr. R. W. E. Leach, of the American Engineering Company, it is learned that during the past week that concern has closed contracts with the Rhode Island Company, Providence, R. I., for Taylor stokers of 5000-hp capacity and with the Narragansett Electric Light Company, also of Providence, for stokers of the same and 7200-hp capacity. It is claimed that these two plants are to be among the most up-to-date in this country. Orders for Taylor stokers have also been placed by the New York, New Haven & Hartford Railroad Company for its Van Nest (New York City) repair shops and by the Fitchburg (Mass.) Gas & Electric Company.

Annual Report of J. G. White & Company, Inc.—The tenth annual report of J. G. White & Company, Inc., was placed in the hands of the stockholders this week. Accompanying it was a brief summary of the main points of interest by J. G. White, president of the company. The balance sheet for the fiscal year ended Feb. 28 showed that at the close of the fiscal year the total debts of the company were less than half of the cash in bank and on hand. Actual profits for the year were nearly $847,000, and after deducting various items for reserves and undistributed expenses a net profit of over $296,600 was shown. During the past year in connection with the reorganization of the company's properties it was found advisable to take up a bond issue which was made in the previous year, and the reserve fund of $300,000 set aside for this purpose made the net profit somewhat smaller than it might otherwise have been. The addition to the surplus was $176,647.95, making the total surplus of the company, as of Feb. 28, $782,169.98.

Decision in the Proposed Louisville Merger.—H. M. Byllesby & Company, of Chicago, have been endeavoring for some time to form a combination of the two gas companies and the four electric companies operating in the neighborhood of Louisville, Ky. Some time ago the necessary ordinances were passed and franchises granted to allow of the carrying out of this plan, but negotiations were then held up by a taxpayers' suit alleging violation of the anti-trust statutes of Kentucky. On May 28 the Court of Appeals of Kentucky handed down a decision to the effect that the proposed consolidation is legal and does not violate any anti-trust provisions of the Kentucky laws. This decision removes the last obstacle to the unification of these gas and electric interests. The conditions of the grant provide for the bringing of natural gas from West Virginia and for a reduction in electric and gas rates. It is expected that the unification of management, together with the decrease in rates, will greatly increase the volume of service.

Proposed Telegraph Extensions in the Middle West.—During the coming summer the Postal Telegraph & Cable Company plans to construct along the right-of-way of the Frisco lines an extension of its telegraph system reaching from Kansas City to Joplin, Mo., and there dividing into two branches, one going eastward to Springfield, Mo., and the other stretching in a southwesterly direction to Muskogee, Okla., from which center short branches will reach to Tulsa, McAlester and Fort Gibson, Okla., and Fort Smith, Ark. These extensions will aggregate 571 miles of new line and will open up to the company sixteen important towns which it has not been able to reach so far on its own lines. It is hoped that the work on these lines will be completed before the first snowfall. Other extension work in which the same company is interested is that being carried on by the North American Telegraph Company in North Dakota by which it is planned to enter the cities of Grand Forks and Fargo by July 1, resulting in important patronage for the Postal-North American system.

NEW YORK METAL MARKET PRICES

	May 26 Bid.	May 26 Asked.	June 3 Bid.	June 3 Asked.
Copper:				
Standard, spot	....	15.37½	.....	15.00
	£ s d		£ s d	
London, standard, spot	68 12 6		66 12 6	
Prime Lake	15.65	to 15.75	.....	15.50
Electrolytic	15.55	to 15.65	15.20	to 15.30
Casting	15.40	to 15.50	15.10	to 15.20
Copper wire, base	17.00		16.50	
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	7.50		7.50	
Spelter, spot	5.40	to 5.45	5.30	to 5.35
Tin, spot	48.20		46.25	
Aluminum:				
Prompt delivery	25.00	to 25.50	25.00	to 25.50
Future	25.25	to 26.25	25.00	to 25.50

OLD METALS

Heavy copper and wire	14.87½	14.62½
Brass, heavy	9.37½	9.37½
Brass, light	8.50	8.50
Lead, heavy	4.25	4.25
Zinc scrap	4.50	4.50

COPPER EXPORTS IN JUNE

Total tons to June 3	495

Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding	DIVIDEND		LAST QUOTATION	
		Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	$9,500,000	.....	.....	16	19
Adirondack Elec. Power, pf...	2,500,000	.....	.....	57	61
Amer. Gas & Electric ($50), c..	2,500,000	2	Q	78	82
Amer. Gas & Electric ($50),pf.	1,537,500	1½	Q	42	45
Amer. Light & Traction, c....	10,395,400	2½	Q	370	380
Amer. Light & Traction, pf...	14,236,200	1½	Q	106	108
Amer. Power & Light, c.....	5,631,400	1	Q	67	69½
Amer. Pwr. & Lt., 6% cum.pf.	5,631,400	1½	Q	80	81
Amer. Pwr. & Lt., opt. warr...	1,604,000	.....	.....	12	13
Am. Pwr. & Lt., 6% notes,'21.	2,199,100	3	S	97½	98
Appalachian Power, c.....	6,000,000	.....	.....	9	12
Appalachian Power, pf.....	2,180,000	.....	.....	49	52
Arizona Power, c.....	3,000,000	.....	.....	9	12
Arizona Power, pf.....	850,000	.....	.....	45	50
Asheville L. & P., 1st s.f.5s,'42	1,100,000	2½	S	92	96
Aug'ta-Aiken R.&E.,s.f.5s,'35	2,588,000	2½	S	89	92
Augusta-Aiken Ry. & Elec.,c.	2,250,000	.....	.....	....	....
Augusta-Aiken Ry. & Elec.,pf	1,500,000	1½	Q	....	....
Augusta Ry. & El., 1st 5s, '40.	967,000	2½	S	98½	....
Central Maine Power, 1st, 5s..	2,502,000	2½	S	94½	97½
Cities Service, c.....	5,499,430	5–12	M	107	110
Cities Service, pf.....	10,195,360	½	M	81	83
Col'bus R;Gas&El.,1st5s,'36..	2,454,000	2½	S	92	95
Columbus Ry., G. & Elec., c....	2,000,000	.....	.....	50	....
Columbus Ry., G. & Elec., pf..	840,000	1½	Q	85	95
Commonw.Edison, cap. stock.	37,764,140	7	A	131	....
Con. Gas, El. & Pr. (Balt.),4½s	11,564,000	2¼	S	87	87½
Consum. Pwr. (Mich.), 5s,'36..	10,088,000	2½	S	92	95
Consum. Pr. (Minn.),1st 5s,'29	9,528,000	2½	S	89	92
Dallas Elec. Corp., 5s, '22.....	3,659,000	2½	S	94	97
Denver Gas & El. Lt., c.....	7,001,300	¼	M	....	....
Denver Gas & El. Lt., gen. 5s.	6,000,300	2½	S	94½	96½
Edi. El. Ill., Boston,cap.stock.	15,603,700	3	Q	265	265
Federal Light & Traction, c...	4,750,000	.....	.....	28	30
Federal Light & Traction, pf..	2,500,000	1½	Q	77	79
Fort Worth Pwr. & Lt., 1st 5s.	1,500,000	2½	S	92	96
Harwood Electric, 5s, '39.....	1,000,000	2½	S	101	103
Kansas City Rwy. & Lt., c....	9,543,080	.....	.....	17	20
Kansas City Rwy. & Lt., pf...	9,407,500	1½	Q	35	40
Kan. City R.&Lt., 1st ref. 5s..	10,200,000	2½	S	82	84
Kan. City R. & Lt.,con.6s,'12..	5,478,000	3	S	88	90
Lincoln Gas & Electric, c.....	2,250,000	.....	.....	30	34
Lincoln Gas & Electric, 5s, '41	796,000	2½	S	....	....
Mobile Elect. Co., pf.....	852,000	1¾	Q	92½	95
Mobile Elect. Co., 1st 5s, '46....	1,696,000	2½	S	90	92½
Northern States Power, c.....	5,975,000	.....	.....	18	20
Northern States Power, pf....	8,386,700	1¾	Q	78	79
Pacific Gas & Electric, c.....	31,908,750	1½	Q	49	51
Pacific Gas & Electric, pf.....	10,000,000	1½	Q	85	88
Philadelphia Electric ($25)...	24,987,750	1½	Q	22	22⅛
Portland General Electric, 5s.	8,000,000	2½	S	98	100
Republic Railway & Light, c..	5,200,000	.....	.....	22	24
Republic Railway & Light,pf.	6,360,000	1½	Q	73	75
Sierra & San Francisco Pwr., 1st 5s.....	6,500,000	2½	S	90	92½
St. Joseph's R., L., H. & P., 5s	4,637,000	2½	S	98	99
Seattle Electric Co.,con.5s,'29.	7,417,000	2½	S	95½	98
Southern Calif. Edison, 5s, '39	10,043,000	2½	S	93	96
Southern Power, 5s.....	5,000,000	2½	S	99	100
Standard Gas & Elec. ($50), c.	9,343,150	.....	.....	9½	10⅛
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	38	39½
Tennessee R., L. & Powr., c...	20,000,000	.....	.....	18	18¾
Tennessee R., L. & Pwr., pf...	10,250,000	1½	Q	73½	75
Western Power.....	14,670,000	.....	.....	17	18
Western Power, 6% cum. pf...	6,000,000	.....	.....	42½	44
Western States Gas & El., c...	3,503,000	.....	.....	40	45
Western States Gas & El., pf..	1,800,000	1¾	Q	80	84
W. Sta's G. & E.,1st&r.5s,'41.	3,400,000	2½	S	92½	95

Personal

Mr. Fred H. Vore has been appointed city electrician for Pasadena, Cal., to succeed Mr. W. H. Reeve.

Mr. Charles White has been appointed general manager of the Portal (N. D.) Electric Light Company.

Mr. W. H. Brown, formerly of the Pacific Gas & Electric Company, Napa, Cal., is now with the Holton Power Company, El Centro, Cal.

Mr. L. A. Baldwin, formerly of Kansas City, Mo., has become superintendent of the Municipal Water & Light Department of Coldwater, Kan.

Mr. A. E. Inglesh, formerly of the Public Service Company at Ottawa, Ill., has become associated with the Gas, Electric & Heating Company at Quincy, Ill.

Mr. J. F. Nisbet has severed his connection with the Triumph Electric & Ice Company, Cincinnati, Ohio, having accepted a position in London, England.

Mr. Clarence M. Lewis, formerly with the Saginaw (Mich.) City Gas Company, has become associated with the Pontiac Power Company, at Pontiac, Mich.

Mr. F. D. Mahoney, consulting engineer of the Luzerne County Gas & Electric Company, formerly at the Plymouth office, is now at the same company's office at Kingston, Pa.

Mr. Ralph E. Tuttle, formerly with the United Electric Light Company of Springfield, Mass., is now associated with the Central Massachusetts Electric Company, of Palmer, Mass.

Mr. H. E. Dunbar, who has been associated with the South Hadley Falls (Mass.) Electric Light Company for the past twenty years, has resigned his position as superintendent and chief engineer.

Mr. B. E. Tabler, formerly traffic manager of the Choctaw Railway & Lighting Company, McAlester, Okla., has been appointed general superintendent of the company to succeed Mr. B. R. Stephens.

Prof. Philip S. Biegler, of the school of engineering of the University of Montana, Missoula, Mont., will spend the summer in the engineering offices of the Washington Water Power Company, Spokane, Wash.

Mr. H. K. Smith, formerly electrical superintendent of the Pacific Division, Isthmian Canal Commission, has become associated with the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

Mr. Edward F. Peck, vice-president of the Newport News & Old Point Railway & Electric Company, has been elected president of the Hagerstown & Frederick Railway. An outline of Mr. Peck's career in the electrical field was given in our issue dated Jan. 20, 1912.

Mr. W. D. Weaver, of Charlottesville, Va., formerly editor of the *Electrical World,* has been elected an honorary member of the Philosophical Society of the University of Virginia, an organization comprising members of the faculty and elected alumni of the university.

Mr. Fred J. Maxwell, auditor of the Eastern Wisconsin Railway & Light Company, Fond du Lac, Wis., and of the Wisconsin Electric Railway, Oshkosh, Wis., who has been stationed in Fond du Lac, has been transferred to the executive offices of the companies in Milwaukee, Wis.

Prof. John Price Jackson, formerly head of the electrical engineering department and now dean of the School of Engineering of Pennsylvania State College, has been appointed commissioner of the recently created department of labor and industry of the State of Pennsylvania.

Mr. F. H. Tidman, for a number of years general manager of the Oklahoma Gas & Electric Company, has become manager of the El Reno (Okla.) Gas & Electric Company, succeeding Mr. H. H. Stephens, who has been appointed general manager of the Everett (Wash.) Gas Company.

Mr. W. E. Herring has taken charge of a special industrial department organized recently by the Stone & Webster interests for the purpose of inducing manufacturing concerns to develop the industrial possibilities of the Puget Sound region in Oregon. Mr. Herring's offices will be in the Pioneer Building, Seattle, Wash.

Mr. E. B. Korst has succeeded Mr. W. Crawford as district superintendent for the Central Illinois Public Service Company at Pittsfield, Ill. The Pittsfield division includes eleven towns.

Mr. Edgar G. Scott has resigned his position as electrical engineer at the Boott Mills, Lowell, Mass., to become superintendent of power and machine shops of the Ludlow Manufacturing Associates, Ludlow, Mass. Since his graduation from Worcester Polytechnic Institute in 1905 Mr. Scott has been successively connected with the Westinghouse Electric & Manufacturing Company, the Boston Elevated Railway Company and N. J. Neall, consulting electrical engineer.

Mr. James E. Hewes has been appointed general manager of the Albany (N. Y.) Southern Railroad, which operates an interurban railway between Albany and Hudson, N. Y., and also supplies electrical energy to Hudson and the towns between it and the capital. Mr. Hewes succeeds Mr. R. C. Smith, who resigned some time ago to accept a position in Jackson, Miss. He is a graduate of Johns Hopkins and for many years was engaged in the construction of both railways and electric light and power stations.

Mr. W. W. Coleman, for the past twelve years with the Union Switch & Signal Company, has been appointed sales engineer in the railway sales department of the Edison Storage Battery Company. After graduation from the Park Institute of Pittsburgh, Mr. Coleman was employed by the Westinghouse Electric & Manufacturing Company and later he was designer for the chief engineer of the Cambria Steel Company. With the Union Switch & Signal Company Mr. Coleman was successively chief draftsman, assistant engineer and designer to chief engineer. His headquarters will be at Orange, N. J.

Mr. W. J. Harvie, whose appointment to the position of railway manager of the operating department of J. G. White & Company, was noted in our issue dated March 2, 1912, has been appointed assistant to the president and engineer of construction of the Hagerstown & Frederick Railway. Mr. Harvie graduated from Syracuse University with the degree of electrical engineer, and has served as electrical engineer for the Syracuse & Suburban Railroad and the Utica & Mohawk Valley Railway and as chief engineer of the Syracuse Rapid Transit Company and the Oneida Railway. He was president of the American Electrical Railway Engineering Association in 1911.

Mr. W. S. Townsend, who has been acting manager of the Albany (N. Y.) Southern Railroad Company for some time, has been appointed assistant general manager of the company with headquarters at Hudson. Mr. Townsend is a graduate of the Worcester Polytechnic Institute and for many years was in charge of the Tri-State Railway & Light Company of East Liverpool, Ohio. When Mr. R. C. Smith resigned as manager of the Albany company over a year ago Mr. Townsend was placed in charge temporarily, there being no assistant general manager under Mr. Smith. The plan of the company now is to have a resident officer at both terminals so as to handle the railway and electric business in the section between Hudson and Albany to better advantage.

Mr. P. T. Glidden, whose appointment as general manager of the Consumers' Power Company of St. Paul, Minn., was announced in these columns on May 24, was born in Massachusetts in the year 1870, reared and educated in South Carolina, and returned to Boston, his native city, in 1887. From 1889 to 1893 Mr. Glidden was with the Holtzer-Cabot Electric Company, leaving its employ to go with the Schaeffer Electrical Company. In 1895 the New York Edison Company added Mr. Glidden to its staff, and for eight years he was with this company in the operating, business and commercial departments. The year 1903 he spent with the Ohio Brass Company. In 1904 he accepted the position of manager of the new-business department of the Binghamton (N. Y.) Light, Heat & Power Company. A year and a half of effort there resulted in his being elected vice-president and general manager. A few months later he assumed charge of the Sayre (Pa.) Electric Company, and a year after he became vice-president and general manager of the Eastern Pennsylvania Power Company, of Easton, Pa., retaining the management of the Binghamton and Sayre companies (all Meikleham & Dinsmore properties) until he became associated with the Louisville Lighting Company, which utility he left to go to St. Paul.

Mr. Theodore Inslee Jones, who is the new chairman of the Commercial Section of the National Electric Light Association, is general sales agent of the Edison Electric Illuminating Company of Brooklyn, and has been for the past year vice-chairman of the Commercial Section. He is also chairman of the Commercial Section electrical merchandising and finance committees. Mr. Jones was graduated from the Massachusetts Institute of Technology with the degree of B. S. in the class of 1896. In that year he began work in the New York office of the American Telephone & Telegraph Company, being identified with the inspection and executive departments. While there he originated and equipped the first school of instruction for telephone traffic, writing the first book of instruction for handling long-distance business. This has since become an important adjunct of all telephone companies' work. After four years with the American Telephone & Telegraph Company he directed the traffic department work of the New York & New Jersey Telephone Company in New Jersey. During this period he began deliverng a course of lectures on telephone topics for the New York Board of Education in the public and high schools of the city. Mr. Jones has continued his lecture work, including electric light, power and railway subjects, up to the present time. Leaving the telephone field in the early part of 1907, he accepted a position as illuminating engineer with the Nernst Lamp Company in New York, a Westinghouse corporation, and while in this position was called upon to organize the sales department of the United Electric Light & Power Company of New York, becoming its first sales manager. After two years' work with the United company, he was invited to take charge of the sales activities of the Brooklyn Edison company, which position he accepted in September, 1909. He reorganized the department, including from that time the advertising and old-building work, which had until then been conducted separately from the selling organization. In less than four years, under Mr. Jones' direction, the sales department has written business amounting to approximately 3,033,472 50-watt equivalents, increasing the company's gross income from $3,700,000 during 1909 to $5,200,000 during 1912. Since the present organization of the sales department, more than 200 private plants have been replaced in Brooklyn by Edison service. Mr. Jones has presented a number of papers before the conventions of the National Electric Light Association and the Association of Edison Illuminating Companies. Among these may be mentioned "Functions of a Sales Department," "Development of Revenue from Existing Customers," "Canvassing by Telephone," "Selling Electricity" and "Instrumental Methods of Measuring Maximum Demand." He is past-statesman of the Sons of Jove, New York district, and is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the New York Electrical Society and the Manufacturers' Association of New York. He is also a member of the Technology Club of New York, the Crescent Athletic Club of Brooklyn and the Long Island Automobile Club.

T. I. Jones

Obituary

Robert J. Daley, superintendent of the Pittsburgh Bureau of Electricity, died on June 2 at his home in that city. He was born in Elyria, Ohio, fifty-seven years ago. Moving to Pittsburgh when a young man, he became associated successively with the Allegheny County Light Company, the Postal Telegraph Company, the Home Telephone Company and the Pittsburgh Board of Underwriters.

Construction

New England

BOSTON, MASS.—Plans have been completed by the Huntington Avenue Improvement Association for the installation of an ornamental street-lighting system on Huntington Avenue from Copley Square to Massachusetts Avenue.

BOSTON, MASS.—Bids will be received by the commissioner of public works, Room 49, City Hall, Boston, Mass., until June 19 for furnishing and erecting an automatic electrically operated sewage-pumping plant in proposed pumping station at Union and Albany Streets (city proper). Forms of proposals and a set of four plans showing general arrangements and details may be obtained at Room 49, City Hall. L. K. Rourke is commissioner of public works.

BROCKTON, MASS.—The Edison El. Illg. Co. has applied for a permit to erect a transformer house (15 ft. by 20 ft., one story high) on Dupont Circle.

FALL RIVER, MASS.—The American Printing Co. contemplates the construction of a power plant in connection with its works here.

MARLBORO, MASS.—The Marlboro El. Co. expects to purchase within the next month 33 series street lamps of 40 cp to be installed in Northboro, which will necessitate a new tub regulating transformer. O. W. Halladay is general manager.

MEDFORD, MASS.—Bids will be received at the office of Charles S. Taylor, Mayor, until June 9 for labor and materials required for an electrical installation in the new annex and the present high school building, in accordance with drawings and specifications prepared by the Richard D. Kimball Co., engineers, 6 Beacon Street, Boston, where plans and specifications may be seen and further information obtained.

NEW BEDFORD, MASS.—The directors of the New Bedford Gas & Edison Lt. Co. have decided to build a new office building with a public electric garage attached, for which plans have been prepared by L. E. Destremps. The cost of the building is estimated at $100,000.

PITTSFIELD, MASS.—The committee on fuel and street lights has recommended the installation of 52 additional incandescent street lamps and six arc lamps. The Pittsfield El. Co. furnishes the street-lighting service.

TURNERS FALLS, MASS.—The prudential committee has been authorized to enter into a ten-year contract with the Franklin El. Lt. Co., of Turners Falls, for street-lighting. Under the new contract the present arc lamps will be replaced with 75-watt and 250-watt tungsten lamps.

WRENTHAM, MASS.—The Union Lt. & Pwr. Co., of Franklin, is installing in this place a street-lighting series incandescent-lamp system (the Pittsburgh Transformer Co.'s outfit), consisting of 151 4-amp, 40-cp Mazda lamps, erected on ornamental posts with hanger arms; the overhead work consists of about 30 miles of wire. The cost of the system is estimated at $9,000. M. K. Kendall, of Boston, has the contract. H. R. Wilson is manager of the company.

BRIDGEPORT, CONN.—The United Illg. Co. is enlarging its power house on Congress Street to twice its original size. When completed the company expects to install a 2500-hp generating unit. C. A. Paul is manager of the Bridgeport division.

Middle Atlantic

FORT ANN, N. Y.—The Kanes Falls El. Co. has applied to the Public Service Commission for permission to operate under franchises granted by the towns of Fort Ann and Granville.

NORTHPORT, N. Y.—Arrangements are being made to install electric motors in the pumping stations of the Northport Wtr. Wks. Co. and the high-pressure system which supplies water to the hills surrounding the village.

PRATTSBURG, N. Y.—A special election will soon be held here to vote on the proposition of lighting the streets of the village with electricity, at annual cost of $1,000.

ROCHESTER, N. Y.—The Rochester Ry. & Lt. Co. is erecting a power house, 40 ft. by 100 ft., on the Genesee River, south of the Platt Street Bridge, which will be equipped with two waterwheels and two generators, one with a rating of 5300 kw and the other of 2700 kw.

SENECA FALLS, N. Y.—Substantial additions will be made to the ornamental street-lighting system here during the next two months. By paying $700 per year additional the system will be extended about 2 miles. The street-lighting service is furnished by the Central New York Gas & El. Co. The company will manufacture the concrete posts. R. C. Smith is superintendent of the local system.

TROY, N. Y.—Mayor Burns has signed the ornamental lighting district ordinance and the engineer has been directed to prepare the necessary specifications.

ALTOONA, PA.—The Penn Central Lt. & Pwr. Co. contemplates the construction of a power plant at Williamsburg. The proposed plant will cost about $1,000,000 and will have a generating capacity of 30,000 hp. A wireless system will be maintained for communication between the plant at Williamsburg and the headquarters at Altoona.

CONNELLSVILLE, PA.—Eight transformers were recently destroyed by fire at the local plant of the West Penn Trac. Co., causing a loss of about $50,000.

LANCASTER, PA.—The Susquehanna Pwr. Co. has purchased property belonging to Frederick S. Brown on the Susquehanna River, in Fulton Township, with a view of erecting a dam for the electric power plant at Conowingo on the Susquehanna River.

LEWISTOWN, PA.—Work has begun on the construction of an electric power plant near Naginey Station by McClenthan Brothers, of Readville. The proposed plant will have an output of 1000 hp, and provisions will be made to increase the generating capacity of the plant as the situation may demand.

MEDIA, PA.—The Council expects to purchase within the next 12 months a 100-kva generator and either a gas producer or oil engine (probable Diesel) for the municipal electric-light plant. Within the next month it expects to purchase ornamental brackets to be attached to trolley poles, which will carry 80-cp tungsten units, and within the next three months a 2½-kw series regulator for incandescent street circuit will be probably purchased. P. E. Ahern is superintendent.

MOUNT CARMEL, PA.—The Edison El. Illg. Co., of Mount Carmel, expects to erect within the next three months 2 miles of three-phase, 2300-volt power-distribution lines, to reconstruct transmission lines, and also to purchase one power feeder switchboard panel, ammeters, two oil switches, lightning arresters and grounding devices, 50 new poles, 3000 insulators, 2 tons of No. 6 fireproof and weatherproof wire, 150 5-amp, 110-volt meters, 2900 ft. Nos 10 and 8 weatherproof service wire and 100 No. 6 electric irons. Within the next six months the company expects to purchase one 750-kw, 2300-volt, three-phase turbo-generator set, panelboards, ammeters, voltmeter, indicating and recording wattmeter and power-factor meter. S. S. Watkins is assistant superintendent.

SUNBURY, PA.—Walbridge & Co., of New York, N. Y., have purchased the controlling interest in the Northumberland County Gas & El. Co., of Sunbury and has taken charge of same.

YARDLEY, PA.—The Reading Ry. Co. has awarded the contract for erection of power house and pump house at Yardley to Fred A. Havens & Co., of Philadelphia, Pa. The building will be 32 ft. by 64 ft., with concrete coal pocket.

ATLANTIC CITY, N. J.—Plans and specifications have been prepared by J. F. McLaughlin for the installation of a municipal conduit (16 ducts) to carry wires and cables, which it is proposed to lay on both sides of Atlantic Avenue from Maine to Jackson Avenue, to cost approximately $250,000.

JERSEY CITY, N. J.—The Public Service El. Co. has taken out a permit to build an addition to its Marion power station on Duffield Street, to cost about $10,000.

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, Essex Building, Newark, until July 1, for furnishing and installing a pumping plant at the Newark Bay pumping station. J. E. Gibson is clerk of commission.

NEWARK, N. J.—The public buildings committee has instructed George Knight, supervising engineer of the almshouse at Ivy Hill, to report as to the economy of accepting a lighting and power contract for such structure as tendered by the Public Ser. El. Co. or installing a private plant for building.

CAMBRIDGE, MD.—The Cambridge Gas, El. Lt. & Pwr. Co. expects to erect within the next six months a three-phase, 12,000-volt transmission line, 12 miles long; also to purchase a substation switchboard, transformers, poles, insulators, etc., one tub transformer, lamps, etc., within the next six months, and within the next few months general supplies. G. Lobo is secretary and treasurer. This item appeared by mistake under Cambridge, Mass., in the issue of May 31.

EASTVILLE, VA.—The installation of an electric-light plant and ice factory in Eastville is under consideration. Stanley Scott and associates are interested in the project.

RICHMOND, VA.—In lieu of resolutions appropriating from $28,000 to $35,000 for ornamental lamps on Main and other streets, the Council committee has recommended an appropriation of $10,000 for additional arc lamps in the business sections.

WASHINGTON, D. C.—Plans are being considered for improving the lighting system on Pennsylvania Avenue from the Peace Monument to the Treasury Building. The plans provide for the installation of 150 arc lamps of 1500 cp. At present there are 75 arc lamps of 750 cp. The new lamp-posts will cost about $7,000. Walter C. Allen is district electrical engineer.

North Central

ANN ARBOR, MICH.—Bids will be received at the office of Gardner S. Williams, consulting engineer, Ann Arbor, until June 16 for the construction of a reinforced-concrete spillway and waste gates for the Argo plant of the Eastern Michigan Edison Co., of Ann Arbor. The work includes 1400 cu. yd. of excavation, 2600 sq. ft. sheet piling, 750 cu. yd. concrete, 19 tons reinforcing steel and 22 tons of structural steel and mechanism. Plans and specifications may be seen at the office of the engineer, or may be obtained upon deposit of a certified check for $10, $8 of which will be refunded uuon return of plans.

HOUGHTON, MICH.—The Houghton County El. Lt. Co. is making

a number of extensions to outlying districts. Otto Snyder, superintendent, has charge of the work.

MARQUETTE, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26 for a conduit and wiring system, gas piping, lighting fixtures, etc., in the United States post office and court house, Marquette, in accordance with drawings and specifications copies of which may be obtained at the above office or at the office of the custodian at Marquette. O. Wenderoth is supervising architect.

NORTHVILLE, MICH.—Bids will be received by the village of Northville at the office of the superintendent of the electric-light plant until June 10 for the construction of a concrete spillway, according to plans and specifications which are on file at the above office and at the office of L. L. Van Tuyl, consulting engineer, Detroit. Samuel Wilkinson is superintendent of the municipal plant.

WHITEHALL, MICH.—The Frugale Pwr. Co. will erect an electric-power plant to be located at Goderich Dock, Whitehall, to cost between $15,000 and $20,000. The equipment will consist of one 125-hp Monarch oil engine, one Westinghouse 180-kva, three-phase, 60-cycle generator and General Electric switchboard (100 kw to 200 kw) and General Electric transformers, 356 25-ft. and 35-ft. cedar poles for 6½ miles of overhead distribution lines. Lamps not yet decided upon. Frank H. Speese, of Whitehall, is engineer in charge.

CINCINNATI, OHIO.—The Cincinnati Pwr. Co., recently incorporated, has authorized Stegner, Hughes & Alves, architects, to prepare plans for a series of independent power plants. It is understood that the company proposes to build small power plants in all sections of the city.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of Board of Education, City Hall, Columbus, until June 23 for furnishing material and doing all work necessary to complete the installation of electric-lighting systems in the Whittier and Hyde Park Public Schools, in accordance with plans and specifications on file in the office of G. W. Handman, business manager, 511 West Court Street, Cincinnati, where blank forms may be obtained.

CLEVELAND, OHIO.—The Continental Gas & El. Co., of Cleveland, expects to erect within the next three months 50 miles of 33,000-volt transmission lines in Iowa and Nebraska and to purchase one 300-kw and one 400-kw generator with engines, etc., and stokers for several small power stations. C. S. Eaton is president.

COSHOCTON, OHIO.—The Coshocton Lt. & Htg. Co. expects to install within the next three months a 4000-kw General Electric steam turbine and to erect 17 miles of transmission lines from Coshocton to Newcomerstown. The company has secured a contract to furnish electricity to operate the plant of James B. Clow & Sons at Newcomerstown (about 450 hp), as noted in the issue of May 17. C. H. Howell is superintendent.

DELPHOS, OHIO.—The Delphos El. Lt. & Pwr. Co. is changing its transmission lines from Main Street to alleys in rear and expects to purchase within the next month material for same, including poles, wires, etc., and within the next two months expects to purchase about 28 three-lamp and 32 five-lamp boulevard posts and underground cable for same, using 60-watt Mazda lamps. The company has within the last four months changed its station from reciprocating engine-drive to turbo-alternator, running condensing, consisting of General Electric Curtis turbine and 500-kw alternator and switchboards. Clarence K. Beilharz is superintendent.

McCONNELLSVILLE, OHIO.—The Marietta, Parkersburg & Interurban Co., has purchased the plant and water-power lease of the McConnellsville-Malta El. Co., of McConnellsville. The sale includes 20-year franchises and 10-year street lighting contracts in McConnellsville and in Malta. The plant will be used by the purchasing company to furnish power in connection with an extension of its system from Beverly to McConnellsville. The main portion of the plant was wrecked by the flood in March.

STEUBENVILLE, OHIO.—The installation of an ornamental street-lighting system throughout the city is under consideration by the Chamber of Commerce.

ELKHART, IND.—The Board of Education has decided to change the lighting system in the new high school building.

FORT BENJAMIN HARRISON, IND.—Bids will be received at the office of the Department Quartermaster, Federal Building, Chicago, Ill., until June 17 for furnishing material and constructing an Isolation Hospital at Fort Benjamin Harrison, Ind., including plumbing, heating, electric wiring and fixtures, etc. Plans, specifications and blank forms of proposals will be furnished on application to the office of the depot quartermaster, Chicago, Ill. Plans and specifications may be seen at the office of the quartermaster at Fort Benjamin Harrison. A. L. Smith is depot quartermaster.

INDIANAPOLIS, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric-vault protection system in the United States post office at Indianapolis, in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian. O. Wenderoth is supervising architect.

JEFFERSONVILLE, IND.—Bids will be received at the office of the depot quartermaster, Jeffersonville, until June 11 for furnishing and installing two 75-hp tubular high-pressure boilers with Dutch ovens. Further information may be obtained upon application to H. R. Perry, depot quartermaster.

PORTLAND, IND.—The city of Portland is contemplating the installation of a new boiler and fittings in the muicipal electric-light plant, to cost $4,000. O. O. Clayton is city engineer.

BELVIDERE, ILL.—We are informed that the Illinois Northern Utilities Co., of Chicago, does not contemplate the construction of a power plant at Belvidere this year. It is possible that a plant may be built here sometime next year.

CHICAGO, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States post office at Chicago, Ill., in accordance with plans and specifications copies of which may be had at the above office or at the office of the custodian at Chicago. O. Wenderoth is supervising architect.

LEWISTOWN, ILL.—Improvements are contemplated by the Lewistown El. Co., including the installation of two or three new boilers, the rating and make not yet determined, and from 75 kw to 100 kw in new transformers, make not determined. A coal and ash conveyor equipment may be installed. Later on the company may install a direct-connected unit with Westinghouse five-panel switchboard and instruments. Overhead-line material will consist of 20,000 ft. of weatherproof wire, etc., from the American Insulated Wire & Cable Co.; underground distribution system for 36 posts for tungsten-lamp clusters will be required. The purchase of 40 series 6.6 amp, 200-cp tungsten lamps and from 100 to 200 meters (type not yet determined) is under consideration. The company will carry electrical supplies and equipment. C. W. King is treasurer and general manager.

MOLINE, ILL.—The City Council has decided to change the present arc-lamp system in the residential district for incandescent lamps.

PEORIA, ILL.—Bids will be received by the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States post office at Peoria, Ill., in accordance with plans and specifications copies of which may be obtained at the above office or the office of the custodian at Peoria. O. Wenderoth is supervising architect.

STERLING, ILL.—The Twin City Booster Club has been formed by business men of Sterling and Rock Falls. The project to install an ornamental lighting system in both cities and over the connecting bridge will probably be taken up.

GREEN BAY, WIS.—The special committee appointed by the Council has recommended that the present arc lamps be abandoned and incandescent lamps erected at every street corner.

HOLLANDALE, WIS.—Plans have been prepared by Herman Azzaline, Sr., for the installation of an electric-light plant in Hollandale. The proposed plant will be operated by water-power.

KILBOURN, WIS.—The Southern Wisconsin Pwr. Co., of Madison, contemplates the erection of a high-tension transmission line from Kilbourn to Portage, via Sauk City, Prairie du Sac and Baraboo. The company proposes to furnish each of these cities with electricity for lamps and motors.

SHEBOYGAN, WIS.—Steps have been taken by the City Council to secure a hearing before the Wisconsin Railroad Commission on the project to establish an electric-light plant.

WAUTOMA, WIS.—The Village Board has granted Charles T. Dahlke, of Neshkoro, a franchise to install an electric-light system here for a period of 20 years. Electricity for operating the system will be supplied from the plant at Neshkoro, 9 miles distant.

BEMIDJI, MINN.—The electric-light plant and dam of the Warfield El. Co., at Warfield, on the Mississippi River, a few miles east of here, was completely destroyed on May 24 by a wind and electrical storm. The plant supplied electricity in Bemidji.

FARIBAULT, MINN.—Bids will be received by the Board of Education, Faribault, addressed to Dr. W. H. Robillard, chairman, until June 14, for construction of new high school building, including general contract work, heating, plumbing and electrical work, in accordance with plans and specifications prepared by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately, to be submitted only on form of bids supplied by the architect. Copies of plans and specifications may be seen at the old High School building, Faribault, and at the Builders' Exchanges at St. Paul and Minneapolis, Minn., and La Crosse, Wis.

LAKE CITY, MINN.—Bids will be received by the Board of Education, Lake City, until June 13 for the construction of an addition to the present High School building according to plans and specifications which are on file at the Builders' Exchange, Minneapolis, Minn., and St. Paul, Minn.; Betcher Lumber Co., Red Wing, Minn., and Alban & Hausler, architects, 407 Chamber of Commerce Building, St. Paul, Minn. Separate bids are desired on general construction, heating, plumbing and electric wiring. F. H. Kemp is secretary.

MAYVILLE, MINN.—Bids will be received by the city of Mayville at the office of the Auditor, C. O. Vangen, until June 10 for furnishing and installing material and equipment for a complete electric-light plant and an addition to the water-works system as follows: Division (1) brick power station; (2) radial brick stack or concrete stack or self-supporting steel stack; (3) boiler-room extension; (4) steam-engine in-

HOUGHTON, MICH.—The Houghton County El. Lt. Co. is making

stallation; (5) electrical equipment; (6) sewer and water mains; (7) pump and pump installation, remote control; (8) bids on old equipment. Plans and specifications are on file at the office of the city auditor and at the offices of the Oscar Claussen Engineering Co., consulting engineer, 312-316 Commercial Building, St. Paul, and at the Duluth Builders' Exchange, Duluth. Copies may be obtained on application to the consulting engineers, for which a charge of $5 will be made to cover cost of reproduction.

WARROAD, MINN.—At a special election held recently the proposition to issue $30,000 in bonds for the installation of an electric-light plant and water-works system was carried. Work will begin on the plant as soon as the bonds are sold.

BELMONT, IA.—W. T. McVasky & Co. is contemplating the installation of an electric-light plant here.

CLARINDA, IA.—The Lee El. Co., of Clarinda, has started work on the erection of a three-phase transmission line 23 miles long. The line will run south from Clarinda through the town of Shambaugh to Braddyville, thence west from Braddyville to College Springs and Blanchard. Twenty-five-year franchises have been granted in all four towns, together with ten-year street-lighting contracts. In most cases 80-cp Mazda lamps will be used, for which the company will receive $25 each per year with midnight service. All material has been purchased. Rufus E. Lee is manager.

DAVENPORT, IA.—Plans are being prepared by the Tri-City Automatic Tel. Co. for the construction of telephone systems in Davenport, Rock Island and Moline, Ill.

DES MOINES, IA.—The City Council has instructed Safety Superintendent Van Liew to ask for bids for the installation of a police signal alarm system in the downtown district.

DES MOINES, IA.—The City Council has voted to install 48 arc lamps at the Seventh Street Viaduct and 100 new street lamps in various parts of the city. The Des Moines El. Co. furnishes the street-lighting system.

HOLSTEIN, IA.—The Holstein Service Co. contemplates the installation of an electric-light plant and expects to purchase a 35-kw direct-current generator, switchboard equipment for six circuits, storage battery, etc.; also about 300 poles and wire for distributing system. W. F. Hutton is secretary.

MANLEY, IA.—The People's Gas & El. Co., of Mason City, has applied for a franchise to furnish electricity for lamps and motors in Manley. If granted a franchise, the company will extend its transmission line here. The company contemplates furnishing electrical service to a number of surrounding towns.

MAXWELL, IA.—A special election has been called for June 10 to submit the proposition to grant a 25-year franchise to W. A. Curtis to construct and operate an electric-light plant in Maxwell.

RUSSELL, IA.—At the special election held recently the proposition to establish a municipal electric-light plant was carried. A transmission line will be erected to Chariton, where connection will be made with the electric plant there.

STATE CENTER, IA.—The State Center Business Men's Association has decided to install a system of electroliers on Main Street. Twenty-one lamp standards will be erected carrying 250-cp lamps.

WASHINGTON, IA.—It is proposed to change the street-lighting system, plans for which will be prepared immediately by the light committee.

GRANT CITY, MO.—The El. Lt. & Pwr. Co., of Grant City, expects to purchase within the next 12 months one 50-kw, three-phase, 60-cycle, 2300-volt generator (not over 1200 r.p.m.), one three-phase single-panel switchboard with instruments and a series tungsten street-lighting system (about 10 kw). G. D. Henderson is manager.

JOPLIN, MO.—The City Council is contemplating improvements to the municipal electric-light plant and extending the municipal lighting system to East Joplin, at a cost of approximately $75,000.

PORTAGEVILLE, MO.—Plans are being prepared by the Portageville Mfg. Co. for the erection of an electric-light and ice plant and stave mill. The equipment will include a 250-hp high-pressure boiler. The remainder of the apparatus has not yet been decided upon.

KENMARE, N. D.—Contracts will soon be awarded for the installation of an ornamental street-lighting system in Kenmare. The plans provide for the erection of 30 lamp standards carrying five-lamp clusters (one 60-watt lamp and four 40-watt lamps), to be maintained by underground wires. P. M. Cole and L. Knudson are in charge of the work.

MOTT, N. D.—S. Stewart, of Morris, Minn., has been granted a 20-year electric-light franchise in Mott and a contract to furnish the village with electricity for a period of ten years.

HUDSON, S. D.—Plans are being considered by the Hudson El. Lt. & Pwr. Co. for the installation of an electric-light plant. The present plans provide for the installation of a 25-kw generator. The street-lighting system will consist of 10 electroliers and 15 tungsten incandescent street lamps; about 75 meters will be used. None of the equipment has yet been purchased. The company will also handle lighting supplies and small household electrical appliances. J. D. Bradley is president of the company and S. F. Hoffman secretary, both of Hudson.

HUMBOLDT, S. D.—Arrangements have been made to extend the transmission line from Hartford to Humboldt.

PIERRE, S. D.—We are informed that the city of Pierre does not contemplate the installation of an electric-light plant, as reported in the issue of May 3. The city already has a plant and is not considering any improvements at the present time. J. A. Rose is city clerk.

NORTH PLATTE, NEB.—The city of North Platte is contemplating the installation of an electrolier street-lighting system. Charles McNamara is city engineer. The North Platte Gas & El. Co. furnishes the street-lighting service.

WILBER, NEB.—At a special election held May 15 the proposition to issue $20,000 in bonds for the construction of an electric-lighting system and installing an exhaust-steam-heating system in the business section was carried. C. O. Martz, of Lincoln, is consulting engineer.

ARCADIA, KAN.—Arrangements are being made for the installation of a municipal electric-light plant in Arcadia, to cost about $8,500. Bids for construction of plant will be received about June 15. E. T. Archer & Co., New England Building, Kansas City, Mo., are engineers.

BEATTIE, KAN.—Arrangements have been made and equipment purchased for rebuilding the electric plant of the Beattie El. Lt. Co., which was recently destroyed by fire. The equipment will consist of two oil engines and two three-phase, 60-cycle alternating-current generators, with switchboard, etc. The company is operating two transmission lines, one to Home City and the other to Summerfield. Harry D. Hockman is manager.

BURR OAK, KAN.—The Council has granted the Concordia El. L.t Co., of Concordia, a 20-year franchise to furnish electricity for lamps and motors here, and a contract for street-lighting, which provides for 40 lamps. The transmission line will be extended from Mankato within a few months. The Concordia company also expects to extend its system to Slottsville, Courtland, Formoso, Kackley and Scandia in the near future.

CHANUTE, KAN.—Plans are being prepared for improvements to the municipal electric-light plant, to cost about $12,000. I. N. Johnson is commissioner of public utilities.

HOLTON, KAN.—Bonds to the amount of $23,110, recently voted, for repairs and extensions to the municipal electric-light plant have been sold.

JETMORE, KAN.—An election will be held June 7 to submit the proposition to issue $10,000 for installation of an electric-light plant and water-works system to the voters.

KANSAS CITY, KAN.—An election will be held June 24 to vote on the proposition to issue $200,000 in bonds for additions and improvements to the municipal electric-light plant. James Cable is water-works and electric-light commissioner. W. Kiersted, 640 Midland Building, Kansas City, Mo., is engineer.

LAWTON, KAN.—Two new mills, it is reported, will be erected on leases of the Eastern Lead & Zinc Co.'s land, which will be equipped with electrically driven machinery. One will be erected by the E. S. L. & H. Co. and the other by the Lawton Mining Co.

TOPEKA, KAN.—Bids will be received by the State Executive Council, addressed to Charles Sessions, Secretary of State, Topeka, Kan., until June 11 for the installation of switchboards, cables, furnishing labor and materials necessary for wiring from the State heating plant to the Memorial Building and State Capitol Building; also the wiring and lighting of sub-basement in State Capitol Building. Plans and specifications may be seen in the office of Charles H. Chandler, state architect, at the State House.

Southern States

GASTONIA, N. C.—The city expects to make improvements to the street-lighting system to cost about $2,500. H. Rutter is superintendent.

GREENVILLE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 11, for construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches, of the United States post office at Greenville, in accordance with plans and specifications which may be obtained at the above office or from custodian of site at Greenville. O. Wenderoth is supervising architect.

LA GRANGE, N. C.—H. H. Sutton & Son, owners of the local electric-light plant, expect within the next three months to erect a new power house and make extensive improvements to their system and within the next six months to purchase one overshoot waterwheel.

LOWELL, N. C.—The Spencer Mountain Mills expects to purchase within the next 90 days some equipment for the village street-lighting system. W. G. Love is treasurer.

MAXTON, N. C.—Dr. J. J. Kincaid, who recently purchased the old Enterprise Mill property, has finished the work of raising the dam, which will enable him to generate about 125 hp. He proposes to install a hydro-electric plant and will purchase equipment for it in the near future.

CORDELLE, GA.—As a result of the reduction in the rates for street-lighting by the Citizens' El. Lt. & Pwr. Co., of Cordelle, 20 or more additional arc lamps will be installed; also a number of 90-cp incandescent street lamps in the suburbs of the city.

DAWSON, GA.—We are informed that the city of Dawson does not contemplate improvements to the municipal electric-light plant as reported in the issue of May 3. R. E. Bell is city clerk.

JACKSONVILLE, FLA.—The Southern Utilities Co., of Jacksonville, is planning the installation of additional equipment in several of its plants as follows: In the plant of the Ariston Ice & El. Co., at Fort Myers, one 300-kw turbo-generator set and four-panel switchboard; the Arcadia Ice & El. Co., of Arcadia, one 150-kw direct-connected tandem-compound unit and four-panel switchboard; the Tarpon Springs Ice & El. Co., of Tarpon Springs, one 150-kw compound direct-connected unit. The machinery has already been purchased. The J. G. White Engineering Corpn., 42 Exchange Place, New York, N. Y., is operating manager. H. C. Adams, of Jacksonville, is general manager.

ALICEVILLE, ALA.—The Aliceville El. Co. is installing an electric-light plant in Aliceville. The equipment will consist of one 35-kw General Electric single-phase, 60-cycle generator, transformers, 36,000 ft. Nos. 8, 6 and 4 wire, and cypress poles, and about 400 tungsten lamps. William F. Wolff, of Aliceville, is engineer in charge.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co. contemplates erecting a 2200-volt transmission line to Lewisburg, Kimberly and Sibleyville to furnish electricity for coal mines and manufacturing plants in that territory and will also install a large turbine engine in its power plant at Eighteenth Street and Powell Avenue. The cost of the transmission lines is estimated at $50,000.

CARROLLTON, MISS.—Within the next three months the town of Carrolltown expects to purchase weatherproof wire, lamps, etc. W. E. Stilson is manager.

PONTOTOC, MISS.—The Pontotoc El. Lt. & Pwr. Co. is contemplating the installation of a water-works system and would like information on mains, pumps, an additional boiler and probably an overhead steel tank having a capacity of from 75,000 gal. to 100,000 gal. L. E. Price is manager.

GREEN FOREST, ARK.—We are informed that the Green Forest Milling & Elevator Co. has purchased all the machinery for its plant. J. Villines is president.

HOPE, ARK.—Within the next two months the city of Hope expects to erect an addition to the power house of the municipal electric-light and water plant for the water pumps. A 300-kw Bullock generator and Filer & Stowell engine (directly connected) are now being installed. Charles M. Richards is superintendent.

MORRILLTON, ARK.—The Morrillton Lt. & Pwr. Co. contemplates rebuilding the electric-light plant, which was destroyed by fire. William L. Moose is president of the company.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States mint at New Orleans, La., in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian at New Orleans. O. Wenderoth is supervising architect.

CADDO, OKLA.—The Caddo El. Lt. & Pwr. Co. expects to purchase within the next 30 days one 15-kw, single-phase, 60-cycle, 1100-volt generator. John W. Thomas is manager.

ELK CITY, OKLA.—The Elk City Ice, Fuel & Lt. Co. expects to erect a new transmission line from its new power house to the center of the town and has recently purchased a 150-hp boiler, a 300-hp Bates-Corliss engine and a new 275-kw Allis-Chalmers generator, exciter, condenser and new switchboard.

HOLDENVILLE, OKLA.—The Holdenville Ice & El. Co. has placed an order with the General Electric Co. for a 150-kw, three-phase, 2300-volt, 60-cycle generator. W. M. Dunn is president and manager.

McCURTAIN, OKLA.—The Twin City Ice, Lt. & Pwr. Co. would like quotations of prices on line material, poles, etc., and will purchase 50 or 60 meters within the next 60 days and some transformers immediately. The company will install next fall one 100-hp high-pressure boiler and one 80-hp high-speed steam engine. Next year the company expects to purchase a new 75-kw, three-phase, 60-cycle generator and switchboard for same. The company will do all the inside wiring in the town. B. A. Little, of McCurtain, is engineer in charge.

NEWKIRK, OKLA.—The city of Newkirk expects to purchase material for an ornamental street-lighting system (three blocks) within the next three months. J. H. Fox is superintendent.

OKMULGEE, OKLA.—The Okmulgee Ice & Lt. Co. expects to increase the generating capacity of its power plant and enlarge the boiler room this fall. Details of the proposed improvements have not yet been worked out.

VALLIANT, OKLA.—An election has been called to vote on the proposition to issue $51,000 in bonds for the installation of an electric-light plant and water-works system in Valliant. E. W. Gantt, Sam Houston Life Building, Dallas, Tex., is consulting engineer.

DALLAS, TEX.—Plans have been prepared by Harry A. Overbeck, 503 Juniata Building, Dallas, for the installation of a power plant in connection with the jail. Bids will probably be received from Aug. 1 to 15.

DENISON, TEX.—We are informed that the Texas Pwr. & Lt, Co., of Dallas, does not contemplate the construction of a power plant in Denison at present as reported in the issue of May 10. F. R. Slater is general superintendent.

FORT WORTH, TEX.—The wagon factory on Fostepco Heights, of the Fort Worth Wagon Factory, Inc., is to be equipped with electric-motor-driven machinery. J. F. Shelton is manager.

FORT WORTH, TEX.—The Mutual Cotton Oil Co., of North Fort Worth, has closed a contract with the Fort Worth Pwr. & Lt. Co. for the installation of electric motors to replace the present steam plant. The contract calls for 11 motors, aggregating 561 hp, to be installed by Aug. 1.

FRANKLIN, TEX.—The city commission is considering the purchase of the water and light plants of the Franklin Wtr. & Lt. Co. If the deal is consummated, bonds will be issued for enlarging the plants and for other improvements to the property.

GALVESTON, TEX.—Bids will be received by John D. Kelley, city secretary, until June 12 for furnishing 60 ornamental posts, combination trolley and arc-lamp design, and 26 ornamental arc-lamp posts, all to be complete with lamps, etc., installed ready for operation. Bids are also to cover the installation of 13,000 ft. of cable. Specifications may be seen at the office of W. D. Masterson, city superintendent of electricity.

PLAINVIEW, TEX.—The Malone Ice & Lt. Co. is doubling the output of its power plant and will erect a system of transmission lines for the purpose of furnishing electricity to operate a number of irrigating pumping plants in this section.

Pacific States

EATONVILLE, WASH.—Arrangements are being made for the construction of a municipal electric-light plant to be located near Eatonville. The present plans provide for the installation of one 50-kw, three-phase, 2200-volt generating unit, impulse type of turbine and oil-type governor. Other data will not be decided upon until the power site is located. Contracts for construction of plant will be let in about two months. Evans-Dickson Co., 725 Commerce Street, Tacoma, is engineer.

PUYALLUP, WASH.—The City Council is considering a proposition of utilizing Salmon Springs as a site for a municipal hydroelectric power plant to furnish electricity for lighting the streets and public buildings and for power and commercial purposes, and also to pump the water from Maplewood Springs (part of the local water system).

TACOMA, WASH.—The Department of Light and Water will soon begin work on the erection of an additional pole transmission line (20 miles long) from the city to connect with the present double line and transfer one line from the single-pole double line. B. W. Collins is superintendent of electric works.

COTTAGE GROVE, ORE.—Investigations are being made at the head of the McKenzie River, above Belknap Springs, and estimates prepared by the Oregon El. Ry. Co. for the construction of a power plant there. G. S. Edmuston, hydraulic engineer, is in charge of the work.

BAIRDSTOWN, CAL.—G. W. Baird, president of the Bairdstown Improvement Association, is promoting the installation of an ornamental street-lighting system from the mountains to the sea. The Board of County Supervisors has been authorized to advertise for bids for the installation of the lighting system along Huntington Drive from Los Angeles to Alhambra.

DAVIS, CAL.—Plans are being perfected by R. T. Stone for the construction of a large irrigating project in this vicinity. Electrically driven pumps will be used throughout the system.

FRESNO, CAL.—Surveys have been made by the San Joaquin Lt. & Pwr. Corpn., of Fresno, for location of a 60,000-volt transmission line along the east side of San Joaquin Valley which will ultimately connect Bakersfield, Porterville and Fresno. Plans for construction of this line (at least part of it) are now being prepared. A. G. Wishon is general manager.

JACKSON, CAL.—Plans are being prepared for the installation of a street-lighting system in Jackson.

LOS ANGELES, CAL.—The Pacific El. Ry. Co. has taken out a permit to erect a substation on Vermont Avenue, to cost about $5,000.

LOS ANGELES, CAL.—The Southern California Edison Co., of Los Angeles, Cal., has applied to the State Railroad Commission for authority to sell 30,000 shares of capital stock at $100, the proceeds to be used for extensions to the Long Beach plant and to pay existing indebtedness.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., of San Francisco, has applied to the State Railroad Commission for permission for a certificate of public necessity for the construction of three additional power plants on the Bear River, in Placer County, and the erection of a transmission line from the Bear River development to Nicolaus in the Sacramento Valley.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States Subtreasury (old) building, San Francisco, in accordance with plans and specifications, which may be had at the above office or at the office of the supervising superintendent, Post Office Building, San Francisco. O. Wenderoth is supervising architect.

TULARE, CAL.—The State Railroad Commission has granted the Tulare County Pwr. Co. authority to issue promissory notes to the amount of $15,971 to cover certain extensions.

ASHTON, IDAHO.—The Ashton & St. Anthony Pwr. Co., Ltd., recently incorporated, contemplates the construction of an electric-light plant near Ashton, to cost about $200,000, work on which will begin in the near future. The proposed plant will furnish electricity for lamps

and motors for towns and cities in this vicinity. N. N. Holm is engineer in charge of construction and A. Whitten is president of the company.

HAILEY, IDAHO.—The Beaver River Pwr. Co., of Boise, has applied to the City Council for a franchise to furnish electricity for lamps and motors.

IDAHO FALLS, IDAHO.—The City Council has decided to install an ornamental street-lighting system on Shoup and Park Avenues and C Street. Cluster lamps will be used.

MIDDLETON, IDAHO.—The Council has granted the Beaver River Pwr. Co., of Boise, Idaho, a franchise to supply electricity for lamps and motors here for a period of 50 years.

MOUNTAIN HOME, IDAHO.—Preliminary arrangements are being made by the Eagle Cove Irrigation Co. for irrigating about 3000 acres of land near Loveridge Ferry on Snake River. Electricity for operating the pumps will be supplied by the great Shoshone & Twin Falls Wtr. Pwr. Co., of Twin Falls. F. C. Horne, of Boise, is engineer of the project.

MOUNTAIN HOME, IDAHO.—The Sweet Briar Canyon Irrigation District, located south of Mountain Home on Snake River, is negotiating for the sale of bonds to secure funds to cover cost of installing an irrigation pumping plant of approximately 300 hp. Electricity for operating the plant will be supplied by the Great Shoshone & Twin Falls Wtr. Pwr. Co., of Twin Falls. Transmission lines have already been erected. F. A. Tolman is engineer in charge.

TWIN FALLS, IDAHO.—The Great Shoshone & Twin Falls Wtr. Pwr. Co. has practically completed excavations for the construction of a canal and flume for a 15,000-hp plant on the Malad River.

FLAGSTAFF, ARIZ.—Preparations are being made by the Flagstaff El. Lt. Co. for the erection of a new electric-light and power plant in Flagstaff. The company was recently granted a new franchise.

FREDERICK, COL.—The Town Board has awarded the contract for furnishing electricity for operating the pumping plant of the new waterworks system and the municipal electric-light system to the Northern Colorado Pwr. Co., of Denver, Col.

GREELEY, COL.—The Greeley Hydro-Electric Co. is planning to erect a power station about 75 miles west of Fort Collins to furnish electricity to two northwestern counties of Colorado. The plans provide for the installation of four 200-hp waterwheels (probably Pelton), Lombard waterwheel governors, General Electric alternating-current generators (cycle and number not yet decided upon); the switchboard equipment has not yet been determined; the transmission line will be about 95 miles long. Active construction work has been delayed. L. L. Stimson, of Greeley, is engineer in charge, and C. A. Fitch is secretary.

WELLS, NEV.—Work will soon be started on the proposed hydroelectric plant to be established on Trout Creek, for which permission has been granted by John H. Cazier and H. H. Cazier. The proposed plant will furnish electricity for lamps and motors in Wells and surrounding territory.

CLAYTON, N. M.—The city of Clayton is contemplating the installation of a new street-lighting system within the next six months. E. E. Kirtley is superintendent.

DEMING, N. M.—The Deming Ice & El. Co. expects to erect at once a large extension to its generating plant and to install high-pressure boilers, turbines, pumps, etc. The company is erecting a 22,000-volt high-tension transmission line and distributing line at 2300 volts to handle contract for 2500 hp. All purchases are made from the New York office of the Federal Lt. & Trac. Co., 60 Broadway, New York, N. Y. Improvements are being made to furnish power for irrigation purposes in the Mimbres Valley; turbines and centrifugal pumps are used with direct motor drive, all of which are vertical. Frank Monser is general manager.

GALLUP, N. M.—The Gallup El. Lt. Co. has within the past four months built an addition to its power station and installed one 200-kw, 2300-volt, three-phase, 60-cycle generator, 18-in. by 36-in. Corliss engine and switchboard. The company expects to purchase within the next three months a 200-hp boiler and within the next two months transformers (100 kw) and 300 meters. A 24-hour service will be started within 60 days.

Canada

KAMLOOPS, B. C.—Tenders will be received by the city of Kamloops until June 12 for equipment for transmission line between Kamloops and the new hydroelectric plant on Barriere River.

MELITA, MAN.—The by-law granting a franchise to R. E. Denny to operate an electric-light plant and street-railway system in Melina has been approved by the ratepayers.

AURORA, ONT.—A by-law will be submitted to the ratepayers early in June authorizing the Town Council to enter into a contract with the Toronto & York Radial Ry. Co. to supply electrical energy to operate the municipal electric system.

BERLIN, ONT.—The Berlin Steam Htg. Co. has offered to sell its plant to the Berlin Light Commission. The commission has asked the company to submit a price on the plant, and, if satisfactory, it is probable that steps may be taken to acquire it.

SAULT STE. MARIE, ONT.—Tenders will be received by R. C. Desrochers, secretary Department of Public Works, until June 11, for the installation of an electric passenger elevator, to include motor-generator set, penthouse, foundation, etc. Plans and specifications may be seen on application to P. J. Racine, caretaker, public building, Sault Ste. Marie, and at the Department of Public Works, Ottawa.

TORONTO, ONT.—The Hydro-Electric Power Commission has authorized the purchase of Wasdel's Falls, from which power will be developed to supply the municipalities of Beaverton, Cannington, Brechin, Sunderland and Woodville, which have signed contracts with the commission for the purchase of energy.

TORONTO, ONT.—Tenders will be received by Adam Beck, chairman of the Hydro-Electric Power Commission, Continental Life Building, Toronto, until June 16 for construction and equipment of a hydroelectric power plant at Wasdell's Falls on Severn River. Separate tenders will be received under the following heads: Dams and power house; electrical equipment; hydraulic equipment; crane; stop-log winch and headgate mechanism. Plans, specifications and instructions to bidders may be obtained at the above office. Tenders for dam and power house must be submitted on form of proposal furnished by the commission. W. W. Pope is secretary.

ESTAVAN, SASK.—The town of Estavan is contemplating the construction of a new electric-light plant to be located on the river about one-half mile from the town. The proposed plant will have an output of about 200 kw, for which bids are now being asked. Chipman & Powers, of Toronto, Ont., are designing engineers. P. J. Stephens is secretary and treasurer.

Mexico

GUTIERREZ ZAMORA, MEXICO.—Manuel Angel Fernandez, of Gutierrez Zamora, writes that he is contemplating the purchase of a 50-hp Diesel engine of the four-stroke cycle type, to be directly connected to a 30-kva, three-phase, 240-volt alternator, and would like to receive estimates of cost of same.

New Industrial Companies

THE DEAN ENGINE COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture engines and motors. The incorporators are: George A. Chritton, N. B. Dearborn and D. C. Thorsen.

THE ELECTRIC MAINTENANCE COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by W. B. Christie, C. E. Winters and A. Baehr. The company proposes to deal in automobile supplies.

THE ELECTRICAL EXPERIMENT COMPANY, INC., of New York, N. Y., has been incorporated by E. Mortimer Boyle, Alfred W. Haywood, Jr., and Edward G. B. Hudson, 185 Hudson Street, New York, N. Y. The company is capitalized at $10,000 and proposes to do a general electrical and mechanical engineering business.

THE ENTERPRISE ELECTRIC COMPANY, of New York, has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $5,000. D. A. Gashan, of New York, N. Y., is one of the incorporators.

THE GENERAL TELEPHONE MANUFACTURING COMPANY, of Augusta, Maine, has been incorporated to manufacture, sell, buy and deal in all kinds of telephone and telegraph instruments and devices. The company is capitalized at $500,000. E. M. Leavitt, of Augusta, is president and treasurer.

THE INGRAM-GRAHAM-GRANT COMPANY, of Jacksonville, Fla., has been incorporated with a capital stock of $25,000, to deal in electrical supplies. The officers are: J. W. Ingram, president; C. S. Graham, vice-president, and H. A. Grant, secretary and treasurer.

THE JOHN FRIEDMAN CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated by Louis Becker, Irving Zimmerman and William F. Linn. The company is capitalized at $10,000 and proposes to do electrical construction and contracting work.

T. W. TEAS & COMPANY, of Chattanooga, Tenn., has been incorporated with a capital stock of $10,000 to deal in electrical supplies. The incorporators are: W. C. Teas, Paul W. Carter, F. A. Rodvic, John Smith and John H. Cantrell.

New Incorporations

SAN FRANCISCO, CAL.—The Exposition Terminal Co. has been incorporated with a capital stock of $100,000 by I. W. Hellman, Jr., James McNab, William Crocker, Henry Fortmann and Leon Sloss. The company proposes to build a railway line from the San Francisco ferry building to the Panama-Pacific Exposition grounds via Tonquin Street.

AUGUSTA, GA.—The Bradshaw Milling & Pwr. Co. has been incorporated with a capital stock of $27,000 by William E. Norrell, James H. Norrell and others.

BROOKS, MAINE.—The Waldo County El. Lt. & Pwr. Co. has been organized with a capital stock of $150,000 for the purpose of operating electric light and power plants. A. E. Kilgore is president and J. W. Hobbs, treasurer, both of Brooks.

WATERTOWN, N. Y.—The Continental Pwr. Corpn. has been incorporated with a capital stock of $100,000 by Victor W. Cutting, George W. Phillips, Jr., Leon Well and S. Gibson, of 320 West Eighty-third Street, Brooklyn.

KALIDA, OHIO.—The Kalida El. Lt. Co. has been incorporated with a capital stock of $10,000 by J. E. Devoe, S. E. Shipp, A. D. Devoe, Pearl E. Devoe and H. D. Grindle.

GEORGETOWN, S. C.—The Georgetown Gas & El. Co. has been incorporated with a capital stock of $100,000 to build and operate an electric system and gas plant and electric railway in Georgetown. The incorporators are: Joseph T. Hayden and Clawson Backman.

PARSONS, W. VA.—The Parsons El. Co. has been granted a charter with a capital stock of $25,000. The incorporators are: J. B. Van Wagener, Byron Trimble and Alexander Murdock, of Pittsburgh, Pa.; C. W. Sheck, of Lebanon, Pa., and J. A. Lynch, of Swissvale, Pa.

Trade Publications

WIRE.—The New York Insulated Wire Company, 114 Liberty Street, New York, has issued Price Booklet No. 23 on its Raven black core, rubber-covered wire.

VIBRATORS.—The Shelton Electric Company, 4 East Forty-second Street, New York, has issued a leaflet descriptive of its vibrators, massage apparatus and hair dryers for home use.

BELT DRESSING.—The Cling-Surface Company, Buffalo, New York, has issued a twelve-page illustrated booklet which advances arguments as to why "Cling-Surface" should be used and contains data regarding results from this form of belt treatment.

ALTERNATING-CURRENT RECTIFIERS.—In an eight-page bulletin, No. 100, a May publication of the Wagner Electric Manufacturing Company, St. Louis, Mo., alternating-current rectifiers for charging small storage batteries are illustrated and described.

CONVEYING MACHINERY.—Bulletin No. 51 of the Robins Conveying Belt Company, 13 Park Row, New York, has for its subject coal and coke crushers, feeders and elevators. Brief references are made to this class of apparatus, accompanied by illustrations and diagrams. A horse-power chart for Robins belt conveyors is given.

RECORDING THERMOMETERS.—Catalog No. 1300, one of the Bristol Company's publications, issued from Waterbury, Conn., is devoted to Bristol Class III recording thermometers for working ranges of temperatures between 60 deg. below zero and 800 deg. Fahr. A number of models for varying applications are shown, as are also specimen sections of different size charts.

WATER METERS.—In a sixteen-page booklet published by the Thomson Meter Company, Brooklyn, N. Y., are given illustrated descriptions of the Lambert water meters, registers, dials, strainers and fish-traps, together with cuts illustrating the component parts of the water meter, a price list and a table showing maximum deliveries, weights and dimensions of Lambert meters. A leaflet containing a number of testimonial letters accompanies the booklet.

FANS.—Colonial single-phase alternating-current motors are described and illustrated in Bulletin No. 41, recently issued by the Colonial Fan & Motor Company, Warren, Ohio. These motors are said to embody radical improvements in mechanical construction over those placed on the market a year ago. The motors are of the induction type with rotating secondary member. They start on the split-phase principle and neither carbon brushes nor commutators are required. Various tables of ratings are given.

AUTOMOBILE TIRES.—The B. F. Goodrich Company, Akron, Ohio, has recently published a sixty-eight-page pamphlet, entitled "Motor Trucks of America," which contains illustrations and the more important specifications of the 1913 American-made models of motor trucks whose manufacturers either furnish Goodrich wireless motor-truck tires as standard equipment or supply them without extra cost when specified. Many models for trucking purposes in a wide variety of industries are shown, all of them using the Goodrich tires.

CONVEYING MACHINERY.—The Peck carrier, manufactured by the Link-Belt Company, Philadelphia, Pa., is the subject of a comprehensive 112-page catalog, known as Book 120 and recently copyrighted by the manufacturers. The Peck carrier, which is used for conveying coal, coke, ashes, cement, sand and other materials, consists of a continuous series of buckets pivotally suspended between two endless chains. The book is excellently illustrated with many cuts and diagrams which tell their story in an interesting manner. The Peck carrier for handling coal and ashes in power plants is illustrated and described, and a list is included of many public utility companies in whose plants this system has been installed.

Business Notes

THE COVIC ELECTRIC COMPANY has moved its New York office from 1133 Broadway to 118 East Twenty-eighth Street.

JAMES R. CRAVATH, consulting engineer, has moved his Chicago office from the Old Colony Building to 140 South Dearborn Street.

C. G. YOUNG.—The banking firm of C. G. Young, Trust Building, New York, has been engaged to make examinations and reports on certain important public utilities in Central America. Mr. H. A. Belden, one of the firm's engineers, will make the local studies.

HAMILTON-BEACH MANUFACTURING COMPANY.—A New York office has been established at 50 Church Street, in the Hudson Terminal Building, by the Hamilton-Beach Manufacturing Company, Inc., Racine, Wis. This office will be in charge of Mr. J. Jorgensen.

COLUMBIA INCANDESCENT LAMP WORKS.—At the Columbia Incandescent Lamp Works of the General Electric Company, St. Louis, there has recently been organized an illumination department with a view to assisting salesmen and all agents handling Columbia lamps in planning improved and efficient lighting installations for isolated plants and central-station customers.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

American Association for the Advancement of Science. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Electric Railway Accountants' Association. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electric Railway Association. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electric Railway Engineering Association. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cooperstown, N. Y., June 23-27.

American Physical Society. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

American Society of Heating and Ventilating Engineers. Secretary, W. W. Macon, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

Arkansas Association Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

Association of Iron and Steel Electrical Engineers. Secretary, James Farrington, Steubenville, Ohio.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago.

Canadian Electrical Association. Secretary, C. E. Bowden, Birkbeck Building, Toronto, Ont., Can. Annual convention, Toronto, Can., June 25, 26, 27.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

Electric Club of Chicago. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo. Annual meeting, St. Louis, July 12.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th Street, New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting first Wednesday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, St. Louis, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga. Annual meeting, Macon, Aug. 14-16.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 19-21.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, F. J. Duffy, Natchez, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y. Annual convention, Minneapolis, June 24-26.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Secretary-treasurer, J. W. Neave, Salisbury, N. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 27, 1913.

[Prepared by Robert Starr Allyn 16 Exchange Place, New York.]

1,062,586. SPRING MOUNTING FOR MAGNET ARMATURES; C. J. Erickson, Chicago, Ill. App. filed Dec. 14, 1905. Armature carried by torsional spring and a striker adjustable toward and away from the armature; used in harmonic ringers for selective party lines.

1,062,589. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 17, 1908. For rolling mills; table which carries the bloom is lowered to pass the bloom through the lower rolls of a "three-high" rolling mill and raised to pass it through the upper rolls.

1,062,590. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed April 23, 1909. Relays respond upon closure of motor circuit to render all accelerating switches inoperative and thereafter operate successively as flow of current through motor decreases to cause successive operation of the accelerating switches.

1,062,629. TERMINAL CONNECTOR FOR SPARK PLUGS FOR EXPLOSIVE ENGINES FOR AUTOMOBILES AND OTHER USES; C. W. Beck, Rockville Center, N. Y. App. filed Jan. 11, 1910. Terminal has a switch device which when opened causes spark to jump between supplemental visible sparking points.

1,062,707. SYSTEM OF CONTROL FOR ELECTRIC CONTROLLERS; J. H. Hall, Cleveland, Ohio. App. filed Nov. 27, 1911. Manually operated controller which directly controls cutting in of resistance but which directly controls the cutting out of only a portion of the resistance, and magnetic switches controlling cutting out of resistance in accordance with current strength in motor circuit.

1,062,708. CONTROL SYSTEM FOR ELECTRIC MOTORS; J. H. Hall, Cleveland, Ohio. App. filed Dec. 16, 1912. Series-parallel system; means for connecting motors in series with each other and the windings controlling the resistance contacts, and means for de-energizing the windings and connecting the motors in series.

1,062,722. PERIODIC CIRCUIT-CLOSER; J. G. MacPherson, Philadelphia, Pa. App. filed Nov. 2, 1911. Attachment controllable from the tracing position of a taxicab whereby the electromotor of the taximeter is actuated to record the tariff for mileage as well as for time.

1,062,728. CONTROL MEANS FOR ELECTRIC SWITCHES; R. C. Pierce, Cincinnati, Ohio. App. filed Nov. 26, 1912. A control lever for the movable die of a welding machine which closes the operating switch upon application of a predetermined pressure and opens the switch upon increased pressure.

1,062,745. ELECTRIC-HEATED STEERING RIM; R. S. Smith, Marshall, Tex. App. filed Aug. 14, 1912. A heat-conducting core surrounded by a resistance element is inclosed between a pair of annular trough-like members which are bolted together to form the rim of a steering wheel.

1,062,754. TELEPHONIC APPARATUS; C. Adams-Randall, Boston, Mass. App. filed Nov. 1, 1912. For automatically relaying or repeating telephone messages; system of electromagnets including a vibrating circuit-closing member and magnet cores forming an adjustable gap between them.

1,062,791. STREET-CAR CONTROLLER; C. and J. G. Munson, Cedar Rapids, Ia. App. filed Aug. 26, 1912. Connections to controller by which the motorman can operate the same from either side of the platform instead of being obliged to stand in the center of the platform.

1,062,799. ELECTROMECHANICAL DEVICE; G. H. Rowe, Chicago, Ill. App. filed Oct. 8, 1909. For percussive drills and like tools; a cushioning magnetic connection is established between the driving device and the reciprocating driven device and auxiliary means increase the force of the working stroke in relation to that of the return stroke.

1,062,801. SERIES-MULTIPLE SWITCH; H. R. Sargent, Schenectady, N. Y. App. filed Aug. 16, 1911. Rotary switch with four posts carrying contact segments located in different planes and different distances from the spindle, and three insulated blades on the spindle in different planes and of different length.

1,062,805. PRODUCTION OF AMMONIUM COMPOUNDS; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 11, 1910. Gaseous mixture containing oxygen, nitrogen and water vapor is passed through an electric arc and the products of the resulting reaction are withdrawn into a space maintained below the disassociating temperature of the reaction products.

1,062,809. ELECTRIC-ARC LAMP; A. G. Way, London, England. App. filed April 1, 1911. For lanterns and projectors; carbons at right angles; inclosed arc; horizontal carbon is fed by a ring clutch operated by a hand lever.

1,062,812. PROTECTIVE DEVICE; D. Basch, Schenectady, N. Y. App. filed Oct. 9, 1912. For transmission systems; switches for disconnecting the feeders from the station, a switch controlling a tie line between the feeders and trip coils controlling the switches.

1,062,824. TELEGRAPH SYSTEM; C. M. Edwards, Galveston, Tex. App. filed April 9, 1912. Selective telegraph system for operating the keyboards of linotype machines from a distance.

1,062,836. INCANDESCENT LAMP; M. M. Merritt, Middleton, Mass. App. filed Nov. 27, 1905. Has an anchor wire sealed into the stem of the lamp, a glass sleeve upon the wire, and separate branch wires sealed into the sleeve and connected at different points in the length of the filament.

1,062,857. ARC LAMP; R. Scott, Newark, N. J. App. filed June 15, 1907. Flaming-arc type; plurality of downwardly converging electrodes are connected in series to produce a plurality of arcs and form a single magnetic field which by acting equally on all the arcs constitutes their exclusive regulating means.

1,062,889. REFILLABLE FUSE PLUG; J. G. Clemens, Buffalo, N. Y. App. filed Sept. 26, 1911. The end caps force fuse-clamping members in yielding engagement with the ends of the fuse.

1,062,896. ELECTRICAL HEAT-STORAGE DEVICE; J. T. H. Dempster, Schenectady, N. Y. App. filed Oct. 7, 1912. Heat-storage mass and a thermal switch rotatably mounted thereon, with the contiguous surfaces of the mass and switch grooved to form contact and separation areas.

1,062,900. WATER-COOLED RESISTANCE; W. L. R. Emmet, Schenectady, N. Y. App. filed Nov. 7, 1910. Rheostat embodying a resistance inclosed in a duct and a condenser system circulating water through the duct to cool the resistance.

1,062,907. MAGAZINE ARC LAMP; E. J. Guay, Lynn, Mass. App. filed July 21, 1909. Single lower electrode of material size and an automaticaly rotated magazine carrying upper electrodes of smaller size.

1,062,918. ELECTRICAL SYSTEM AND APPARATUS THEREFOR; J. W. Jepson and A. McGary, New York, N. Y. App. filed Aug. 20, 1909. For charging storage batteries; carbon-pile resistance in series with battery, coil for controlling said resistance responsive to variations in battery current, and means controlled by the coil for opening the battery circuit.

1,062,920. SAFETY LAMP PLUG AND SOCKET; H. C. Jones and C. M. Weeks, Somerville, Mass. App. filed Jan. 17, 1913. To prevent unauthorized removal of lamp or socket; device having a plug to seat in a socket and provided itself with a lamp-receiving socket, a pointed screw being forced into engagement with the lamp and another pointed screw being forced into engagement with the socket in which the device is seated.

1,062,966. PROCESS OF ELECTROLYSIS AND APPARATUS THEREFOR; K.S. Guiterman, New York, N. Y. App. filed Nov. 11, 1912. Creates current of electrolyte to wash slime from the electrodes and collect the suspended slime, removes slime and a portion of the electrolyte, separates slime from the electrolyte and returns electrolyte to the bath.

1,062,974. OZONIZER; N. M. Hopkins, Washington, D. C. App. filed Feb. 26, 1913. An electrode consisting of a thick sheet of metal electrodeposited on a dielectric layer; heat-radiating coils in contact with the electrode; air to be ozonized is passed between the electrodes and a separate current of cooling air is passed over the radiators.

1,062,978. ELECTRIC WORK-CIRCUIT-REGULATING MONITOR; F. Kraemer, Chicago, Ill. App. filed Dec. 14, 1906. For preventing fraudulent and illicit use of current under a "flat-rate" contract; when additional translating devices not bargained for are put in the circuit a monitor cuts in resistance and then after a time cuts it out, thus giving warning and notice that the illicit use has been detected.

1,062,982. PROCESS OF PRODUCING ELEMENTARY SILICON AND BY-PRODUCTS; F. J. Machalske, Philadelphia, Pa. App. filed May 13, 1912. Splits up the silicious compound by electrothermic fusion and subjects the fused mass directly to centrifugal action.

1,063,026. ATTACHMENT PLUG; G. W. Goodridge, Bridgeport, Conn. App. filed Jan. 25, 1913. One-piece porcelain body with longitudinal wire passages therein opening adjacent the binding screws.

1,063,035. INCANDESCENT ELECTRIC LAMP; R. Jahoda, Vienna, Austria. App. filed Dec. 23, 1911. Crossed members spaced one above the other on an axial support and filament extending between the ends and intermediate points of the bars.

1,063,035.—Incandescent Electric Lamp.

1,063,058. SPRINKLER SUPERVISORY SYSTEM; C. F. Patterson, Orange, N. J. App. filed June 17, 1912. Heating means raise locally the temperature of the water in a certain part of the conduit and a thermal device is operated by the fall of temperature due to a flow of water in such localized area to give an alarm.

1,063,096. SIGNAL SYSTEM; G. S. Williamson, McKeesport, Pa. App. filed Aug. 23, 1912. Combined telephone, telegraph and alarm apparatus ordinarily used in connection with the police and fire departments of a municipal system.

1,063,097. ELECTRIC SPOT-WELDING MACHINE; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed Sept. 18, 1911. Holders are constructed to support the welding points in angular relations to produce welds in places which would be inaccessible to ordinary spot-welding machine; has a set of auxiliary point holders with detachable water-supply connections.

1,063,101. THERMAL CIRCUIT-CONTROLLING DEVICE; G. Adam, Paris, France. App. filed July 17, 1911. Permanently located socket and a detachable plug which carries the circuit-controlling mechanism; plug carries a distinguishable portion which becomes detached upon heating.

1,063,167. OZONE-PRODUCING MACHINE; D. C. Smith and F. M. Hummel, Des Moines, Ia. App. filed Aug. 14, 1912. Hollow dielectric tube centered between electrode teeth and carrying a centrally disposed conductor.

1,063,170. ELECTROMAGNETIC APPARATUS; J. C. Lincoln, East Cleveland, Ohio. App. filed Sept. 27, 1909. For curing meats; tank with electrodes therein, whereby current is passed through the tank contents, and magnets having pole faces arranged to maintain the tank contents in a magnetic field.